February 1958

Agriculture

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The "foster-child"

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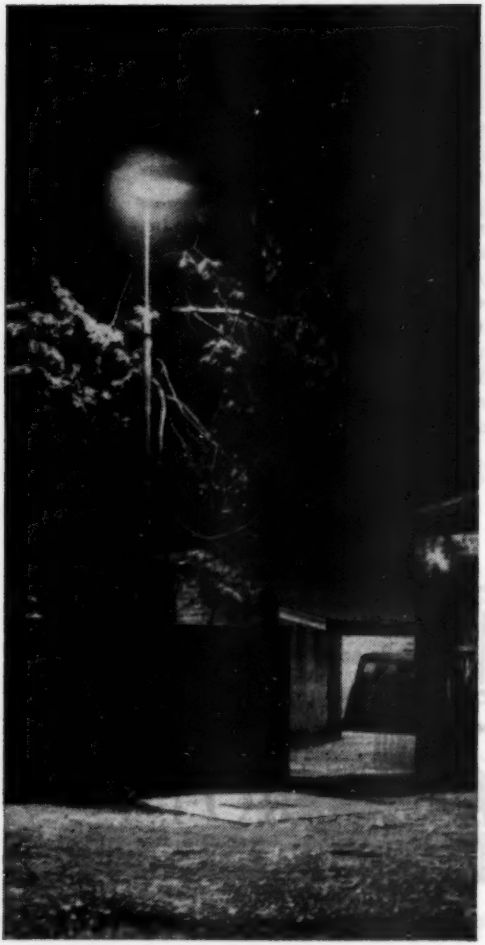

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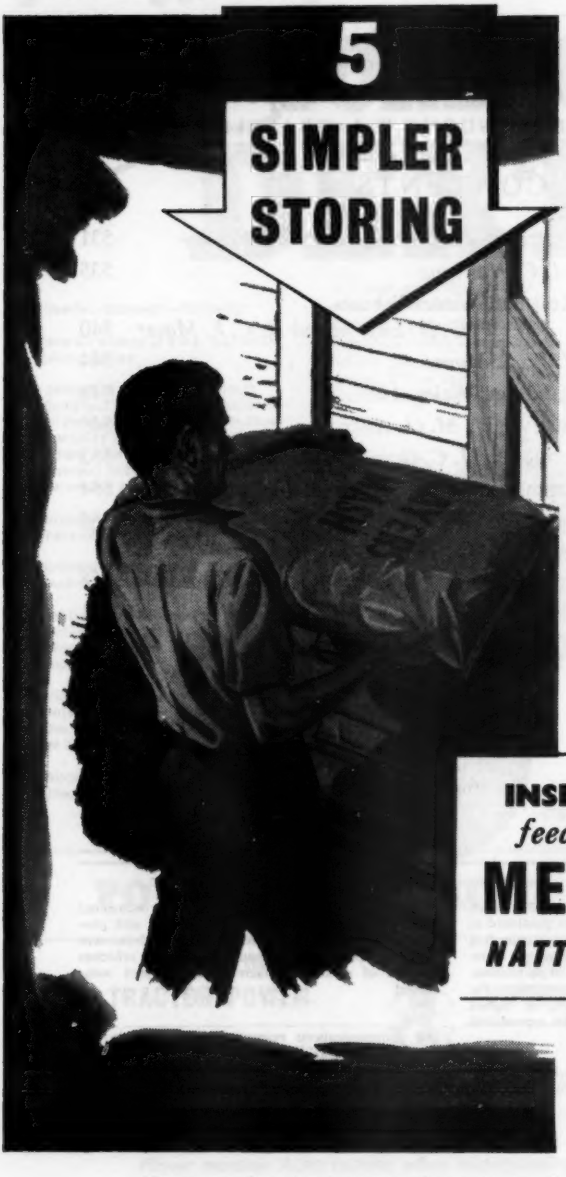

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The Changing Farming Pattern

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School of Agriculture, University of Cambridge

Living standards of arable farmers have increased over the past twenty years owing to improved techniques of production and more intensive farming systems.

A POPULAR slogan at the moment tells the general public "they never had it so good". Certain sections of the community have disagreed with this dictum, but on the whole it must be patently true for the majority of the working population. The question that is of immediate interest is to see whether farmers have participated in this improvement. In this article, use is made of data that have already appeared in a report from the School of Agriculture at Cambridge University*, supplemented by additional information derived in the course of the survey on which the report is based. It would be presumptuous to suppose that evidence from the eastern counties could justly be applied to the whole country, but at least it would be reasonable to apply it to other areas of similar production—namely, arable cropping often with livestock enterprises in addition.

The comparison to be made is between the pre-war and post-war years for four districts of East Anglia. The districts used in the calculation have remained constant throughout the period under review, but naturally the sample of farms has changed. Therefore it is not strictly a constant sample, but as the farms are chosen at random within these districts, a fair representation of the changes within these areas can be obtained. The districts consist of two heavy land areas, one medium and one light. All are predominantly arable, but two have considerable livestock populations as well, particularly dairy cattle, pigs and poultry.

Income in terms of cash

In Table 1 the annual results from 1935 onwards have been grouped into four roughly equal periods, covering respectively conditions of pre-war, war-time, recovery and expansion, and consolidation. The average farm income per acre in each year has been expressed as an index, based on the grouped average of the years 1949–53 equalling 100. As can be seen, the pre-war monetary farm income was only 25 per cent of the base, whereas during the war it was nearly trebled. In the period of recovery and the beginning of expansion the rise was not nearly so great, but in the last period it leapt ahead, owing to the very successful years 1953–55.

Actually in 1956 the index fell from 140 to 121, and a further drop may have occurred in 1957; the high standard of prosperity shown for the last period will now seem a little unreal to many farmers. But these figures refer

* *Report on Farming* (No. 46), School of Agriculture, Cambridge University, price 3*s.* 6*d.*

only to monetary returns and they must be adjusted for changes in the purchasing power of money before a realistic comparison of farm income can be made.

Table 1

Index of monetary and real farm income per acre 1935–56

(1949–53 = 100)

Years	Monetary farm income *per acre*	Real farm income *per acre*
1935–39	25	64
1940–45	70	123
1946–51	81	107
1952–56	122	130

Income in terms of purchasing power

The correction of monetary farm income for change in money value has been made in terms of the consumer price indices and is shown in the second column of Table 1. Here an interesting point can be seen. The real income before the war was about doubled during the war, although monetary income went up by almost three times. Then in the immediate post-war years, while the monetary income continued to rise, though very much more slowly, the real income dropped substantially. Finally, in the last period the real income rose to the highest point, reflecting in part the great rise in monetary incomes in the same period. That is to say, profits in money terms rose faster than money depreciated, so that farmers were better off. Again, with recent events in mind this last result may cause surprise, but it must be remembered that this study ends with 1956, and in that year the index of real incomes fell from 146 to 121, embodying not only the fall in money income already noted but a further drop in the value of money.

There can be no doubt that the farmers in this sample are better off, in real terms, than before the war. This is due to the fact that their monetary returns have risen faster than the value of money has fallen. While some of this is due to increases in unit prices—milk at over 3*s*. per gallon, compared with 1*s*. before the war—the fact remains that great increases in productivity have also contributed to this result. Average district yields of the staple crops—cereals, sugar beet and potatoes—are about 30 per cent above the pre-war level, due to modern methods of cultivation, new varieties and the greater use of fertilizers. In the latter case, the volume has increased by four times over the pre-war level.

Livestock, however, have not shown the same marked increases. While the average milk yield has risen, due in part to the elimination of the worst cows, yet the better herds have levels not markedly higher than were obtained by similar herds before 1939. The same tendency is noticeable in pig production, where conversion factors achieved by the top herds differ little from those ruling before the war. Only in the case of poultry have yields increased markedly, and this is due to the widespread introduction of "indoor" methods—henyard, deep litter and battery. But in addition to these changes in levels of productivity, there has been a shift in emphasis in the pattern of production.

Trend to farming specialization

In Table 2 the farms in the sample are classified according to the system used in the above-mentioned report. Once again it must be stressed that this is not a constant sample, but the classification gives a fair picture of the districts in the years concerned. From this table it can be seen that livestock farms have increased at the expense of purely cash-cropping farms, rising from about half to nearly two-thirds of the total.

Table 2

Distribution of farm types

Farm type	1938 *per cent*	1956 *per cent*
Arable with little livestock		
Mainly cereals	16	25
Mixed crops	32	12
	48	37
Arable with livestock		
Mainly dairy	15	20
Mainly pigs and poultry	10	16
Dairy, pigs and poultry	6	11
Mixed livestock	21	16
	100	100

This increase is particularly marked in the more intensive types of livestock farm, such as those with large pig or poultry units or carrying dairy cows alone, and there has been a decrease in the "mixed livestock" category, which were really a miscellaneous group and could not be fitted into the other classes. This suggests a trend towards specialization in the more intensive lines, coupled with the normal arable cash cropping which is a feature of almost all farms in the sample. It cannot be stressed too strongly that this increase in livestock farms does not mean a reduction in cash crop acreage, but that livestock enterprises have been added to the existing cropping, or that sheep and cattle have made way for dairy cows.

The same tendency towards specialization is noticeable on the farms that have remained in the "stockless" category. There has been a marked reduction in the "mixed crops" group—again a miscellaneous assortment—while the predominantly cereals group has increased appreciably.

Further evidence on this shift in the pattern of production is available. Table 3 is reprinted from the report already quoted, and shows the shift in pattern from a constant sample of 230 farms during the three-year period 1954–56. This differs from the previous table in that it is not restricted to the four districts, but is derived from a wider survey embracing the eastern counties. It is more interesting in that the change in classification occurred on a quarter of the farms. This is surprising because the period is a relatively short one, and it usually requires a strong impetus to make any farmer change appreciably an organization that is paying, and the evidence in the early part of this article demonstrates that farmers were better off during the main part of these three years than they had been for twenty years. Nevertheless, the same tendency towards intensification was noted, with an increase in the intensive types of livestock and a decrease in the

stockless farms. Again there was a decrease in the heterogeneous groups "mixed crops" and "mixed livestock", but here the "mainly cereals" group also declined in numbers; nevertheless they still form the largest single group of farms in the sample.

Table 3

Changes in the type of farming

Farm type	Number of farms		
	1954	1956	Net change
Mainly cereals	62	54	− 8
Arable with mixed livestock	37	30	− 7
Mixed cropping	37	35	− 2
Arable with dairying	43	42	− 1
Arable with dairy, pigs and poultry	17	25	+ 8
Arable with pigs and poultry	34	44	+10
	230	230	

Conclusion

It appears that arable farmers, in the eastern counties at least, have a higher real income than before the war, and during the last five years their real income reached the highest level for twenty years. On the other hand, during 1957 there was a drop both in the monetary and real income.

This rise in income was partly due to increased prices, but also greater productivity in individual enterprises, such as higher crop yields. But in addition there is evidence that part of the contribution has been due to a greater degree of specialization, in that one or two major enterprises are found to have been given greater prominence in the organization of the farm, rather than the farmer having a very mixed group of enterprises with no one predominating. Further, there is also evidence that the pattern of arable farming has intensified by the increase in livestock enterprises in addition to the basic cash cropping. Therefore, the potential and actual output of these farms has been rising steadily, owing not only to improved techniques but to more intensive organization.

British Council Courses for Overseas Specialists

Among the British Council's courses for 1958 are three on agricultural subjects: Recent Advances in Agricultural Engineering (to be held at Silsoe, June 1–14, fee £42), Mineral Nutrition of Farm Animals (at Aberdeen, June 15–July 3, fee £44) and Grassland Agronomy (at Reading, July 6–19, fee £43).

Full details may be obtained from the British Council, 65 Davies Street, London, W.1.

Potato Harvester Design

J. C. HAWKINS, B.SC., N.D.A.

National Institute of Agricultural Engineering

The complete mechanical harvesting of potatoes without damage to the tubers still eludes our agricultural engineers. Mr. Hawkins reviews the present position and draws attention to the coming market for pre-packed quality potatoes.

IN order to lift an acre of potatoes in Britain, a harvester must dig and separate anything from about 125 to 450 tons of a mixture made up of soil, clods, stones, potatoes, haulm and weeds. The proportions of most of these constituents can vary very widely, depending on the soil type and its condition. Clods may be absent altogether on light sands and peats, although quantities as great as 176 tons per acre have been recorded on heavier land. In the same way, there may be no stones at all or more than 75 tons an acre, and the yield of potatoes can range from under 5 tons to over 15 tons per acre. Haulm and weed, however, are usually a more constant quantity at between 1 and 2 tons per acre on main crops. The harvesting of a crop of potatoes on average land, then, could involve the handling of 350 tons of material, made up of 240 tons of soil, 80 tons of clods, 19 tons of stones, 10 tons of potatoes and a ton of haulm and weed. If a complete harvester is to manage only 2 acres a day, allowing time for stoppages, it must handle, each minute, 22·9 cwt of soil, 7·6 cwt of clods, 1·8 cwt of stones and 0·1 cwt of haulm and weed, to harvest 1 cwt of potatoes. It is very important to keep these amounts in mind, if the job that a complete potato harvester is expected to do is to be seen in true perspective.

The obvious way to make the work of a complete potato harvester easier is to look for some method of reducing the quantity of soil, clods and stones which must be handled to be sure of getting all the potatoes. The quantities are so large mainly because all potatoes now grown have been bred for harvesting by hand. For hand-picking, they must come away from the haulm easily when ripe and so have to be shovelled up by a harvester together with the ridge of soil in which they are grown. If, however, all tubers remained firmly attached to strong haulm at harvest, it would be possible to gather the whole crop without including any soil, clods or stones at all. The plants could be loosened by a share passing under them and lifted complete by grasping the haulm between belts, as is now done with ground-nuts. The tubers could then be removed from the haulm, clean and undamaged, by a pair of rubber rollers. The breeding of such a potato appears to be the only way of producing a really cheap and simple potato harvester needing no operator; but such a complete solution to potato harvesting problems is so far away at the moment that efforts must be made to mechanize the harvesting of the kind of potatoes now grown.

The operations that a harvester must perform can be divided up into digging, soil separation, haulm and weed separation, and clod and stone separation. It is convenient to think of them as distinct stages, as here; but

in considering the design of harvesters, it must be realized that each stage is part of a continuous process and so all are very closely inter-related.

Shares

A good potato harvester share will lift the whole crop by taking up the minimum amount of soil and will not block. Potatoes normally grow in a space roughly elliptical in cross section, about 17 inches wide and with the base just over 2 inches below the original seed potato. The perfect share will obviously take up only this part of the ridge; but it would have to be positioned so accurately that in practice it is necessary to take up a little more to allow for errors in ridging, planting and steering with the harvester. Suitable fixed or plate shares exist, but they are very liable to blockages at the sides from haulm and weed and may, too, become blocked with soil. Under some conditions, the value of soil/metal friction is so high and the exposed area of metal in the share so great that it is impossible to muster enough strength in the soil of the ridge ahead to force it over the share, which ceases to scour and blocks. It is better then to use a moving share, such as a disc from a disc plough which is neither blocked by haulm and weed nor affected by high soil/metal friction, or a plate share with the smallest possible area of metal exposed to the soil. Both of these do not lift the ridge more than about an inch and so determine to some extent the type of soil-separation mechanism which can work with them. Elevator chains, for example, are not very suitable because at the pick-up point they have much greater thickness than the edge of, say, shakers or spiders. This is a good example of how components, usually considered separately, are really very closely related and must be considered together in any multi-stage machine like a potato harvester.

Soil-separation

If a potato harvester is to be simple and cheap, there should be as little of it as possible. Soil represents by far the largest ingredient of the ridge to be separated, so a large part of any harvester must consist of a soil-separation mechanism. To keep this, and hence the harvester, small, it is desirable to choose a mechanism that will remove the maximum amount of soil per unit area in a given time. It is not possible to do this in practice because its action is then so severe that potatoes are damaged. It is always necessary to reach a compromise between efficiency and gentleness by finding a mechanism that will remove soil as quickly as possible without damage to potatoes, and this will always be larger and more expensive than the most efficient separator.

There are three main types of soil separation mechanism in common use, the agitated conveyor, the drum and various forms of sieve, both reciprocating and rotary. Agitated conveyors are the most usual, but they have a number of serious defects. Unless carefully adjusted, they can damage potatoes and are not very efficient on heavy, wet soils. They are easily jammed by sharp stones and on some soils have a high rate of wear. On a light sandy soil, for example, one particular complete harvester, using only various forms of chain conveyor, has cost 30 shillings an acre in spare parts alone, so that

the total maintenance and depreciation charges have approached £5 an acre.

The rotating drum is, under many soil conditions, one of the most efficient separation mechanisms with a low rate of wear. It can, however, damage potatoes by its tumbling action, if not used carefully, and it may cause very serious damage on stony land by tumbling potatoes and stones together. It may also form clods on wet, heavy soil and does not deal with haulm and weed very well. Forms of sieve or riddle are probably the most suitable because they have no parts moving in relation to each other in the soil and hence there is a low rate of wear. They are less likely, too, to damage potatoes seriously because they move chiefly in the plane of the separating surface and so do not cause potatoes to bounce violently. The damage which does occur is usually in the form of skin abrasions which are removed by peeling. Sieves are, however, often less efficient as soil separators than other mechanisms, unless designed carefully so that the material on them does not reach the speed of the separating surface until it is discharged. Of the two types of sieve, reciprocating and rotary, the latter is probably to be preferred because it is simpler and cheaper. Reciprocating riddles are difficult to balance completely in work and so, unless well designed and well made, they are very liable to fatigue fractures.

Haulm and weed separation

Haulm and weed can be dealt with ahead of the harvester or in the machine itself. Any efficient form of chopping or pulverizing ahead can avoid blockages in the machine, but this entails the costs of an extra machine for the purpose and of the separate operation. It does not, however, avoid the need for a haulm and weed separation process in the harvester. Haulm must be chopped extremely finely to be separated completely with the soil, and in any case the root system of the plants will remain to be separated in the machine. Spraying is of little help in the disposal of haulm and weeds because it merely kills them off, leaving dead material which can still cause blockages and remains to be separated. In fact, if haulm and weed has to be treated mechanically ahead of a complete harvester to avoid blockages, it is a good indication that the design of the harvester itself is at fault.

The alternative of taking haulm and weed untreated into the harvester means that the machine must be designed to avoid blockages. It is likely to provide the better solution because the physical properties of plant materials are so different from those of potatoes, soil, stones and clods that a simple mechanical separation is possible. Among the mechanisms used are fans, riddles, sloping conveyors and rollers. An air blast will remove haulm and weed very effectively, but is more expensive than other methods and demands more power. Riddling on a chain or shaker conveyor with widely-spaced bars is commonly used and removes most of the haulm and weed, although some will become broken or doubled-up and so pass through it. Sloping conveyors with suitable surfaces will carry haulm and weed with them and allow potatoes, stones and clods to roll off. This is a method used to help to separate potatoes from clods and stones, and the same mechanism is often called upon to do both jobs in a harvester. Separation of haulm and weed by roller depends on the choice of a pair pressed together, or a single one in

contact with a moving surface, of such a diameter that haulm and weed are gripped and potatoes are not. For most British conditions rollers about 6 inches in diameter are suitable.

Stone and clod separation

If a complete potato harvester is efficient in other ways, it will produce a mixture of potatoes, stones and clods all roughly of the same size. Clods are more difficult to separate mechanically than stones because their physical properties are closer to those of potatoes. There is some evidence that the number of clods can be reduced by correct cultivations. Clods left in the original seedbed and formed during inter-row cultivations may well persist in the ridge until harvest. It is likely their number can be reduced substantially if a clod-free tilth is produced for planting and if subsequent cultivations are done only when the tractor wheels do not form clods and with ridging bodies which do not smear and compress the side of the ridges. The number of stones to be separated depends, of course, on the soil type, and little can be done about this.

Whatever precautions are taken before harvest, there will still be on most soils some clods and stones to be separated from the potatoes, and no completely automatic harvester is possible until a reliable mechanical separation has been developed. Much experimental work has been done on this, but as yet no satisfactory mechanism has been found. Complete separation is possible in brine or a suspension of soil in water, but the potatoes are damaged. Similarly other methods using differences in hardness or resilience have given a complete separation only by damaging potatoes. Electrical methods, using differences in resistance and capacity, have not yet proved suitable for use in the field.

The most promising approach has been to make use of differences in shape and rolling resistance to give a partial separation which is completed by hand-picking. The mixture of potatoes, stones, clods and often small weeds and pieces of haulm is fed on to a conveyor which slopes sideways or in the direction of the run of the belt. The belt surface may be smooth or may carry a series of small projections. Potatoes tend to roll sideways off the belt or down it against the run, depending on the design. At best this system can only give a partial separation needing hand correction, but experiments have shown that the speed and efficiency of hand work can be helped considerably by the correct placing of the pickers and the correct presentation of the mixture to them. It is likely that, for some time to come, complete potato harvesters will have to depend on this type of final separation unless the type of potato described earlier is produced and so removes the need for any kind of separation.

Blockages

In addition to the various stages in a complete potato harvester discussed above, there are a number of general principles which need to be followed if the machine is to be efficient and economical on the farm. Careful design is needed to avoid blockages from haulm, weed and soil. The number of stationary parts with which they come into contact should be kept to the

minimum because haulm and weed are likely to become caught and soil may build up there. Such a soil build-up can be reduced by using a flexible material like sheet rubber, which will move under impact and so shed soil, or by using bars instead of a plane surface. If a series of bars is used in a harvester, the gaps between them should increase slightly in size in the direction of flow to avoid clods and stones becoming jammed between them. The same principle applies to the complete components that go to make up a harvester. Space in them should also increase progressively in the direction of flow, and reductions in space can only be made safely between one component and the next.

Damage

Tuber damage is rapidly becoming a very serious problem indeed with the current trend to wash and pack potatoes before they are offered for sale. Washing shows up damage, and so it is as well to remember at all times that potatoes may not be allowed to fall more than about 6 inches on to a hard surface if damage is to be avoided altogether. Such drops, or equivalent blows, are likely to occur where potatoes are made to change direction or speed in the harvester and in the trailer when handling in bulk. Soil is a most effective cushion in the early stages of a machine, but when it has been removed rubber or other padding is needed. Usually none of this is effective unless it is at least half an inch thick or in the form of a thin sheet supported only at the edges.

In conclusion it can be said that a fully automatic complete potato harvester for Britain has not yet been produced and is not likely to be for a number of years yet. A simple and cheap automatic machine could, however, be produced at once if potatoes had been specially bred for mechanical harvesting. In the meantime the performance of current harvesters can be improved by the use of shares which are not blocked by soil or plant material and will lift the whole crop with the minimum of soil and of soil-separation mechanisms which have a low rate of wear and do not damage potatoes. In fact, more attention will have to be paid to the reduction of damage to the tubers in the machine and during transport in view of the current trend to wash potatoes before sale. There is no known mechanism that will separate potatoes from clods and stones completely without damaging the potatoes and the development of one, suitable for use in the field, is probably the most important step forward that could be taken in the improvement of current potato harvesters.

The Breeding of Disease-Resistant Winter Wheats

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Plant Breeding Institute, Cambridge

In the struggle against such cereal fungus diseases as yellow rust, loose smut, mildew and eyespot, the work at Cambridge to produce new resistant varieties continues unremittingly.

THE importance of controlling losses caused by the fungus diseases of wheat has long been recognized. In Britain, losses due to disease are not so serious as they are in some other parts of the world, and it is unusual for whole crops to be written off as a result of disease. Many of the diseases prevalent in Britain may, however, cause losses of 10–20 per cent, and as resistance to most of these diseases is genetically controlled, breeding for such resistance is clearly of importance.

In planning a breeding programme for the introduction of resistance to disease, it is necessary first to survey the available sources of resistance. This may be introduced either by hybridization with known resistant varieties or by the exploitation of artificially induced mutations produced by X-rays, by neutrons or by radiations from radioactive sources.

The use of artificially-induced mutations in crop improvement is difficult, since there is no means at present known of controlling the nature of the mutations caused; moreover, as most of these are harmful, it is necessary to examine large numbers of treated plants if there is to be a reasonable chance of isolating useful forms. On the other hand, it is sometimes possible to isolate mutations similar to their parental type except for the introduction of some valuable character, such for example as mildew resistance in barley, though small changes in other characters are usually seen in resistant plants.[1] In this way a change which could only have been achieved by a slow programme of hybridization and selection is completed in a single operation.

In spite of this advantage, however, the absence of control over the nature of the mutations produced limits their value as a tool for the plant breeder, so that hybridization forms the basis of most of the work on disease resistance at Cambridge. Where, as is usually the case, such resistance is determined by a simple genetic mechanism, it is a relatively easy matter to select resistant progeny from crosses between resistant and susceptible varieties, though the problem may be complicated by the occurrence of physiologic races of the fungi concerned. The breeding of a disease-resistant variety is economically valueless, however, unless it yields as well as susceptible varieties in the absence of disease and outyields them when disease occurs. Attention must also be given to other features of importance to the farmer. Such characters as straw height and stiffness, winter hardiness and grain quality must always be considered, and they often present difficult problems when resistance is derived from parents introduced from parts of the world where conditions differ markedly from those in Britain.

Yellow rust

Yellow rust (*Puccinia glumarum*) is a serious disease of wheat in Britain and in some years may cause a loss in yield of at least 20 per cent in susceptible varieties.[2] It is also found that a severe attack may result in a shrivelling of the grain, with associated loss in quality and increase in the proportion of tail corn. The genetic basis of resistance to rust has long been known and utilized by plant breeders,[5] but the repeated appearance of new physiologic races capable of attacking previously resistant varieties has greatly added to the problem of breeding for resistance. On two occasions during the past few years new races of the rust have appeared and done considerable damage to varieties previously considered as resistant. In 1951 a new race, designated race 2B, appeared. This race attacked the variety Nord Desprez, at that time one of the most widely grown varieties, and certain of the other new continental varieties. It caused such damage that these varieties declined markedly in popularity and have subsequently disappeared from the market or are grown only on a very small scale. Again, in 1955 another race appeared, attacking the formerly resistant variety Heine VII, but unfavourable conditions both in 1956 and 1957 prevented the rust from reaching epidemic proportions on this variety in Britain, although it suffered much more severely on the Continent.

Five physiologic races are used at the Plant Breeding Institute for testing the yellow rust resistance of breeding material. Tests of disease reaction are carried out both on seedlings and on adult plants. This is because it has been found that although plants which are resistant as seedlings remain resistant throughout their development, many seedling susceptible plants develop some degree of resistance as they mature. Seedling resistance is thus the objective at which the plant breeder aims, since this gives complete control throughout the development of the plant, but other considerations must determine whether a plant which is seedling susceptible but resistant as an adult plant should be retained.

Table 1 shows the reactions of some of the varieties used in crossing when inoculated as seedlings with each of the five physiologic races used in tests at the Plant Breeding Institute.

Table 1

Seedling reactions of wheat varieties to physiologic races of yellow rust (Puccinia glumarum)

	Race				
	2	2B	5	8	8B
Banco	S	S	S	S	S
Cappelle Desprez	R	S	R	R	R
Heine VII	R	R	R	R	S
Holdfast	S	S	S	S	S
Hybrid 46	R	R	R	R	R
Ministre	R	R	R	R	R

Note: S = susceptible; R = resistant

Inoculation of early generation hybrids (F_1 and F_2) between these varieties has shown that resistance to each race is determined by one or more independently inherited factors, most of them genetically dominant. It has also

been found that resistance to a given race may be determined by a single factor in one cross but by two or more factors in other crosses. The further investigation of these factors constitutes an important part of the current research work on yellow rust resistance.

Breeding work now in progress involves crosses between varieties shown in Table 1 and crosses between these and susceptible varieties showing other desirable characters. Particular promise has been shown by selections from crosses of Cappelle Desprez, Hybrid 46 and Ministre with Yeoman and Holdfast.

Loose smut

Losses due to loose smut (*Ustilago tritici*) and mildew (*Erysiphe graminis*) may be serious although their importance, at any rate in Britain, has not been so generally recognized, and work on breeding for resistance has only recently been started. In both these diseases the problem of physiologic races has arisen and complicated the breeding work, though in the case of mildew we have little knowledge of the number or distribution of physiologic races in Britain. Three races of loose smut (*Ustilago tritici*) are known in Britain,[4] and experiments are in progress at the Plant Breeding Institute to obtain information concerning the genetical basis of resistance to these. Tests are also carried out to determine the reactions to loose smut of advanced hybrids developed at the Institute, and Table 2 indicates the reactions of certain varieties used as parents and gives the number of selections in each of a group of more advanced crosses showing resistance to two of the three physiologic races. The resistance of Cappelle Desprez to all three races may be noted.

Table 2

Reactions of wheat varieties and of hybrids between them to physiologic races of loose smut (Ustilago tritici)

	Parental reactions		
	Race C_1	Race C_2	Race C_3
Yeoman	R	S	R
Holdfast	R	S	R
Cappelle Desprez	R	R	R
Hybrid 46	S	S	S

	Reactions of hybrids			
	Race C_1		Race C_2	
	Resistant	Susceptible	Resistant	Susceptible
F_4 Yeoman × Cappelle	13	0	6	11
F_4 Yeoman × Hybrid 46	17	15	0	34
F_4 Holdfast × Cappelle	20	0	12	12
F_4 Holdfast × Hybrid 46	14	9	2	25

Note: S—susceptible; R—resistant

Mildew

Breeding for resistance to mildew has proved difficult, since there are few parental types available showing resistance to this disease. Resistance is shown, however, by some of the more primitive wheat species such as

Triticum timopheevi and *Triticum carthlicum*; the most advanced material at the Plant Breeding Institute is based on a derivative of *T. timopheevi*. Work is also in progress on hybrids deriving their resistance from *T. carthlicum* and from hybrids between wheat and rye. The chromosomes of *T. timopheevi* are not fully compatible with those of the bread wheats, as the two species have different chromosome numbers, but a back-crossing programme in America has produced a variety CI 12633 which carries the resistance of *T. timopheevi* and can be readily crossed with the bread wheats.[5] CI 12633 has been crossed with Cappelle Desprez, Hybrid 46, Ministre and promising new hybrids which have been developed at Cambridge. Apart from its disease resistance, however, CI 12633 has little to recommend it, as it is a low-yielding, weak-strawed variety with very little winter hardiness. A further back-crossing programme has therefore proved necessary. Three back crosses have so far been completed, but it is expected that a further three will be necessary before a useful resistant variety can be selected.

Eyespot

Eyespot (*Cercosporella herpotrichoides*) is another disease, the importance of which has only recently been appreciated. Marked varietal differences in susceptibility to this disease, which causes lodging and premature ripening of the ears, have been demonstrated,[6, 7] the variety Cappelle Desprez showing considerably less damage than other varieties. In a recent trial in which infected and non-infected plots of a number of varieties were compared, it was found that Heine VII suffered a 25 per cent loss in yield due to eyespot, Holdfast a 16 per cent loss, and Ministre and Hybrid 46 a 12 per cent loss. The average yield of infected plots of Cappelle, however, was only 3 per cent lower than those of the uninfected controls. Since the danger of loss due to this disease is increased under the conditions of intensive cereal cropping demanded by present economic conditions, the breeding of resistant varieties is clearly of value.

There is no evidence of the existence of physiologic races of eyespot, and experiments have shown that the resistance of Cappelle Desprez is undoubtedly hereditary, though no clear-cut genetic ratios have been obtained. Hybrids between Cappelle Desprez and susceptible varieties show varying degrees of susceptibility, ranging from types nearly as resistant as Cappelle Desprez itself to others as susceptible as the second parent. Although no fully resistant selections have been found, however, the information concerning susceptibility to eyespot is of considerable help in assessing the value of new hybrids.

Long-term investigations

In a breeding programme it is clearly impossible to introduce resistance to all diseases in one step, especially as other characters such as yield, grain quality and field characters must be considered at the same time. The breeder must therefore concentrate his attention on the more important diseases and at the same time take precautions to see that no variety is released which is unduly susceptible to one of the lesser pathogens. Never-

theless, a longer-term approach is possible, and is being undertaken at the Plant Breeding Institute. By a slow process of synthesis and testing, an attempt is being made to gather together into a group of highly resistant cultures all the known factors for resistance to the important diseases. If such lines can be produced, and their resistance maintained against the changing pattern of physiologic races, the work of the plant breeder would be greatly simplified. It will, however, be necessary to maintain a continual survey of possible new sources of resistance, since there is little doubt that new physiologic races of the pathogens will appear as resistant varieties are developed and brought into cultivation.

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Quality Dessert Apples

J. W. S. MOUNT

Canterbury

Quality in dessert apples means not only good appearance but good flavour—and English apples properly grown and well marketed are second to none.

IT is not possible in a short article to do more than lay down certain principles which should be followed if one aims at producing a high quality dessert apple. It is, in fact, not possible to lay down any hard and fast rules, since there are many ways and methods by which we can produce the same result, and the variation of soil and climate must also be taken into account.

The right site

Climate is the first consideration in choosing a site. Sufficient rainfall is required, 25–30 inches or the availability of water to apply by irrigation. Sunshine is important, and that is why most of the apple-growing districts are sited in the south and east of the country. The last two years have shown the danger of planting trees on ground which is too exposed, but

more about shelter later. In the south-east we have found that there is also a limit to the height at which quality fruit can be grown. Any land over the 400 feet level is very liable to low cloud and early morning mist, which encourage all fungus diseases such as canker and apple scab, and the colder atmosphere at that level does not allow the fruit to finish properly. The importance of climate is shown by the superb finish of a great deal of the imported fruit, compared with our home-grown apples. But skin finish is not all that is required. I consider *flavour* to be more important, and that is where our climate has the advantage. Rainfall, sunshine and temperature all combine to give our apples their unique flavour.

The apple tree is one of the most accommodating of plants, and it will grow on almost any type of soil, provided there is sufficient humus and the ground is well drained. Good drainage is most important. No apple tree will put up with wet feet. A great deal of so-called manurial deficiency is due to inadequate drainage, which in turn leads to spray damage and poor quality fruit. It is, of course, more expensive to grow fruit on some soils than on others, but quality fruit can be grown if the management is correct. We grow some of our best quality Bramleys on a light loam overlying chalk, where the depth of soil is not more than 12 inches, but we have to apply heavy dressings of organic manure to prevent the trees from drying out. Perhaps the most difficult type of soil is the light sandy soil, where the amount of rainfall has a more marked effect on growth and quality.

Earlier, I mentioned shelter as being a necessity. I think that the last two years have rubbed in that lesson, but what type of shelter to use is a difficult question. There are many alternatives, and most of them have one drawback or another. Hedges are expensive to maintain, although considerable progress has been made with hedge-trimming machines. Spruce and larch are slow to establish. Poplar is widely used, as it is quick growing and makes an effective wind-break, but it is susceptible to the silver leaf fungus, and its roots reach well out into the orchard and so tend to block the land drains. I am surprised that more growers do not use hop lewing for this purpose. Its only drawback is the initial cost, but it is very effective, and surely our Cox plantations are as valuable as our hop gardens. Fifty years ago many of the hop gardens in Kent were grubbed and planted with fruit. They were sheltered and the soil was very fertile. Some heavy crops were grown in these orchards when the spring frosts passed them by, and it was only after a particularly bad run of radiation frosts that growers started to plant on higher ground. They obtained more regular crops, but they lost the benefit of the shelter, and we are just beginning to realize it. Shelter is also very important when spraying, because a great deal of damage is done to the fruit and to the trees when spraying in cold, windy weather. One cannot always wait for a calm day.

The right stock

Having chosen the right site, it is necessary to choose the right stock for the type of soil and the method of growing. There is a wide range of stocks from which to choose, and there is no excuse for anyone to plant anything but good, clean, virus-tested material, for remember that these trees will have a life of fifty years and upwards. The tendency today is to plant more

of the dwarfing type of tree, which can be more easily sprayed, pruned and picked, and I am sure this is a step forward in producing quality fruit. We look forward to some promising material coming from the new Type 9 crosses at East Malling Research Station in the near future. I would certainly advocate the planting of a filler on a dwarfing stock if the permanent plant is to be 20 feet or more, not only from the economic point of view, but because of the extra shelter obtained.

All young trees should be given a good start. Firm staking and tying are essential, and mulching is a help on some soils; but the mulch should be kept away from the stems of the young trees; otherwise it may encourage damage by field voles.

I have concentrated on the environment and necessity of planting the right type of tree and of planting it properly, because if a mistake is made in any of these first principles the trees will never produce high quality fruit. It will take a long time before this fact is realized and there is no alternative to grubbing up and starting again. We are still grubbing our mistakes of twenty-five and thirty years ago.

The way to quality fruit

A big step forward in producing quality fruit was the introduction of the gang-mower into the orchard in 1934. This method of frequent mowing of the grass sward has enabled us to build up the humus and improve the soil structure. It has improved the colour and skin quality of the fruit and also the keeping quality to a marked degree, but a close watch has to be kept on the health and vigour of the trees, because the tree roots are now competing with the grass roots for moisture and nitrogen. We have found it necessary to go back to the original idea of a short-term ley and plough up for two or three years, and then allow the natural grasses to grow into a sward. By this means we invigorate the trees by ploughing up, and avoid the check in grassing down again by allowing the sward to come back naturally, rather than sowing a grass mixture. Two things must be emphasized: (1) that only the surface should be broken up, otherwise the tree roots will be damaged (we find that a rotovator is the best tool for this job), and (2) lack of growth and vigour after several years of grassing down is probably due to lack of moisture; an area with a higher rainfall than we have in south-east England would probably find this practice unnecessary.

Pruning and manuring are two important factors in the production of quality apples, and they are very much inter-related. There has been a tendency to prune trees less in the last few years, and unless the nitrogen has been increased to compensate for this, there will be a danger of undernourishment of the tree. I do not believe that quality depends on the type of pruning, provided the branches of the tree are spaced sufficiently to allow plenty of sunlight and air to penetrate to ripen the fruit buds and colour the fruit. It is also important to have the branches well spaced for adequate control of pest and disease by spraying. There are no hard and fast rules for manuring, except to maintain a healthy tree with good foliage and sufficient leader growth to maintain vigour. The tree itself is one's barometer, but it is a good idea to look at your neighbour's trees for the sake of comparison.

Pollination is necessary for any fruit to set, and as most varieties are

partially self-sterile, cross pollination is essential. One cannot always ensure that the pollinator will blossom at the same time as the main variety so two pollinators flowering at slightly different times are better than one. If there is a scarcity of wild bees in the district, it is advisable to import some hive bees during the flowering period. We have hired bees for many years, and put them in the orchards at a rate of one hive per acre. It is a good plan to shelter the hives as much as possible, as the bees will be more willing to face the uncertain spring weather if they can fly from a warm, sunny spot.

Spraying practices are changing rapidly, and many growers have different ideas about which is the best method of applying their sprays. Far more attention is being paid to the damage that is caused to the tree and the fruit by spraying, which is all to the good. I think we shall find that the amount of insecticide and fungicide that is applied to the tree will be reduced as the technique of applying it improves, but at the moment we are going a little too fast in that direction.

I believe that we grow the best flavoured apples in this country and we are in danger of throwing away that advantage. Our plant breeders are concentrating on colour more than flavour, and are using highly-coloured foreign apples for this purpose. I believe that the British housewife will quickly learn to choose the well-flavoured apple in preference to the highly-coloured, flavourless varieties that come from overseas. We should concentrate on the russets and the Cox, and such varieties as Laxton's Fortune, Laxton's Epicure, Merton Worcester, Egremont and St. Edmund's Russet, Lord Lambourn and a new one that we are trying out, Kidd's Orange Red. Every grower should have a patch on his farm where he can try out new varieties, since some do much better in some districts than in others.

Why spoil by bad marketing?

It is extraordinary the number of growers who still spend eleven months of the year striving to produce good quality fruit and who then ruin it by bad handling and marketing. Every grower should visit the market regularly to see how his fruit is arriving and how it compares with other consignments, or at least have an occasional package sent back for inspection. I should like to see a standard container for apples, but the raw materials are so short in this country that there is little hope of this wish being fulfilled in the near future.

Education in the proper handling of fruit is badly needed, and when one considers the number of hands through which this fruit passes before it reaches the consumer, there is little wonder that it sometimes shows considerable bruising. We can make a start by seeing that the handling in the orchard which is under our supervision is as perfect as is humanly possible. The next step is in the packing shed, and this part of the journey needs more study and supervision than any other part of the process of marketing. I am quite sure that there is room here for a great deal of improvement. Once the fruit leaves the packing shed, it is out of the grower's hands, and this is where the Ministry of Agriculture and organizations such as the National Farmers' Union and the Fruit Growers' Association can help by demonstration and exhortation.

There is scope for more co-operation in marketing and growing, the kind

of co-operative which need involve growers in no capital outlay. For instance, there are many young people being trained in the universities and colleges who would be ideal for the post of technical adviser and inspector of marketing for any co-operative. Co-operation in marketing, provided a high standard is maintained, is the best answer to competition from abroad.

There is an unlimited demand for good quality English apples and, provided we improve our technique of marketing them, we need fear no unsubsidized competition from overseas.

Glasshouse Statistics England and Wales

CROPS GROWN IN GLASSHOUSES (July 1957)*

	July, 1956	July, 1957
	acres	*acres*
Total Area of Glasshouses		
With heating apparatus	3,789	3,763
Without heating apparatus	786	803
Total	**4,575**	**4,566**
Crops in Glasshouses at July		
Tomatoes:		
grown in glasshouses fitted with heating apparatus	2,299	2,200
" " " not fitted with heating apparatus	583	587
Cucumbers	464	495
Other vegetables and herbs	35	38
Grapes	32	30
Peaches and nectarines	16	14
Other fruits	3	3
Carnations	193	199
Roses	121	129
Orchids	10	10
All other flower and foliage crops	427	443
All other crops not specified above	73	92
Remaining glasshouse area (being the area unused at census date, or used for purposes not shown above)	319	326
Total	**4,575**	**4,566**

*Including Dutch light structures which were glazed at the census date. The figures are in respect of holdings which had not less than 1,000 square feet of glass excluding lights and/or cloches.

The American Broiler Industry

W. M. O. ALLCROFT, B.SC., PH.D.
Ministry of Agriculture, Fisheries and Food

Dr. Allcroft, who has recently been in America, believes that the American broiler industry has some ideas which we could use, and he suggests that it would pay the British industry to send a few selected men to study American breeding and learn what grading really is.

ACCORDING to the Oxford Dictionary, the verb "to broil" means to cook over an open fire or on a gridiron; and this was the general method of cooking broiling fowl over sixty years ago, when they were a New England seasonal luxury in May and June. The only birds available then were the surplus males from commercial egg-laying strains.

Around 1925, broilers began to be produced all the year round, largely as a means of absorbing and utilizing an over-production from the live-bird kosher trade, and again the main expansion was in the New England States and in the peninsula which forms the eastern shore of Chesapeake Bay. The first official broiler census undertaken by the U.S. Department of Agriculture was in 1934, and some of the highlights of production figures from then until 1956 are given in the following table:

Broiler production in the United States

	Total U.S. production	Chesapeake Bay peninsula		Georgia, N. Carolina and Alabama	
	millions	*millions*	*Percentage of total U.S. production*	*millions*	*Percentage of total U.S. production*
1934	35	10	28·6	1½	4·3
1942	210	100	47·6	20	9·5
1945	350	140	40·0	52	15·0
1956	1,200	185	15·5	360	30·0

Two important trends are shown in these data: firstly, the great expansion of total production which began in 1942; and secondly, the post-war shift of production to the Southern States. In 1942 America entered the Second World War, and at that time the price of chicken meat was still above that of red meat. The need to send much of their red meat to American servicemen overseas created an urgent need for an alternative meat supply at home. Since broilers could be quickly multiplied and America had all the necessary feedingstuffs without the import and convoy problems that faced us, the expansion of broiler production was rapid and the price of chicken meat fell below that of red meat and has remained there ever since.

On the second point the development of synthetic fibres such as nylon gave the American cotton industry a severe knock. Since much of the cotton production in the Southern States was on smallholdings, they soon felt the chill winds of depression and were forced to seek other sources of income. Broiler growing does not require much land since the birds are kept

intensively on as little as one square foot per bird. Thus broiler houses soon replaced cotton growing. The temperature in these areas is relatively mild, with very little variation between day and night and between winter and summer, and so it was possible to use relatively cheap and simple housing compared with what was required in the colder New England States. Also the cost of labour for tending the birds and for the processing plants was low. Broiler production, through the use of the litter cleaned out of the houses at regular intervals, has also materially improved the general soil fertility of the old cotton holdings and allowed the keeping of a few cattle either for milk production or for beef.

Finance—an unstable system?

As capital was short in these cotton smallholding areas, broiler growing has been financed on what is called the vertical integration system, which is really only a system of long-term credit made available by the feedingstuffs and drug manufacturers. The grower provides the land, the housing and the day-to-day labour for looking after the birds. The feed dealer provides the birds (which remain his property until they are sold to the processing plant), the food and drugs (which he gets on extended credit), and the gangs of men who deliver and finally collect the birds and carry out such jobs as debeaking, vaccinating, etc. The grower is thus no more than a paid operative of the feed dealer and works on an agreed contract, of which there are several variants. The feed dealer normally works with only one processor, and the two between them arrange the timing of the various batches of birds so that full use is made of the capital invested in the processing plant by keeping it fully and steadily supplied. A processor will naturally have to work with one or more feed dealers according to the throughput that he requires.

This vertical integration seems unsound and about as secure as a pyramid balancing on its apex: it can only survive as long as food and drug sales can be maintained or expanded, and once recession starts and the arrears of credit begin to be called in, the whole structure could collapse very quickly and bring disaster to many people. Because of the enormous expansion of the industry, broilers have been selling below the cost of production since mid-1956, and without some cut in production the situation will worsen till it may become uneconomic for many producers to stay in business.

By-products are valuable

All birds are sold alive off the farm and, after processing on factory assembly line methods, most of them are sold eviscerated and oven-ready—even cut up. Refrigeration starts at the processing plant and is continued throughout transportation and the wholesale and retail stages of distribution.

A comparatively recent but expanding development has been the conversion of much of the processing plant waste back into poultry feedingstuffs. The feathers are made into a meal, and the heads, necks, intestines, legs, etc., are made into by-products meal. The blood is also dried and made fit for stock feeding. All these meals are of good feeding quality and go some way to making good the relative shortage of animal protein in the country. Even the fat expressed in the manufacture of the by-products meal is used as a

source of energy. In Georgia they say "We process everything but the squawk, and one day we'll find a use for that as well". The use of fats as a dietary source of energy is quite common, and since there is little difference between the cost per unit of energy between fat and maize, they can be used alternatively according to ruling prices. In Britain fats are a much more costly source per unit of energy than are cereals, and so they are not widely used; it seems unlikely that they will be until their price per unit of energy attains parity with that of grains.

What is wanted: how it is obtained

The American broiler of today is a very highly-developed bird, produced by a relatively few large organizations, from lines specifically bred for the purpose. It is rare for any broiler chick to be a pure breed and the breeders have tended to specialize in the development of one parent line for sale. Between the two sides of the breeding industry there exists extremely close co-operation, and a vast amount of detailed mutual testing of lines goes on. The object of this testing is to produce parent stock which, when cross-mated, will result in high fertility, egg production and hatchability in the parent stock so that chicks can be sold cheaply, and in chicks that grow and feather well and have the desired table conformation with a high proportion of edible meat, a large part of which is breast meat. Yellow legs and skin are desirable in America and do not carry the 3*d*. a lb penalty that is imposed by the wholesale trade of this country. The birds not only look and handle well alive or dead, but, as experience proves, they are excellent eating. This is largely because of the emphasis that has been laid on rapid development, and the flesh is mature even at the tender age of 9½–10 weeks. One of our handicaps is that our traditional breeds do not really produce a mature flesh until they are 16 weeks or older, and that is no use for broilers.

The American bird is all-white or nearly so, and this characteristic has been attained in the last few years by fixing the dominant white genotype in the male lines. The most popular male line in 1956 was the Vantress White Cornish, which sired 60 per cent or more of the 1,200 million birds produced. It was developed in a few years by Charles Vantress, who left his family's farms in California, taking with him a nucleus of the Vantress Red Cornish stock that had been the sire line of the winning entries in the "Chicken of Tomorrow" contests in 1948 and 1951. The dominant white has been fixed in this stock, as a guess, by the infusion of White Leghorn blood, which has also accelerated the early growth of both the basal breed and its progeny. As far as the breed itself is concerned, this is shown by the fact that the males selected for the breeding of replacements weigh 10–10½ lb as adults but must have attained 5 lb at 10 weeks old.

We can learn from America

The importing of American stock is sometimes suggested as a simple way of improving our broiler strains in a short time, but it is highly doubtful if it would be. There is no reason to suppose that their stock would do as well as, let alone better than, our own stock under our conditions. Even if it did, none of their top flight breeders would consider sending over here both sexes

of the grandparent stock necessary to produce the parent stock of the final cross, so we should have to depend on recurrent imports under franchise arrangements. In view of the exceptionally high selection pressure which has been used to produce the very few genetically stable lines in use today, it is unlikely that they would nick satisfactorily with more than a minute fraction of our genetically unstable lines. Really closed flocks in this country are few and far between.

The American broiler industry is a great commercial enterprise with many features of interest and, be it said, some faults. We need not, and indeed should not, follow their methods slavishly, but we should certainly use our intelligence to see which of their principles are applicable under our conditions.

We need first to set about producing the right type of bird before expansion proceeds too far, otherwise our broilers will have a bad name with the housewife. Another urgent need is to improve our broiler grading at the processing plants. It would pay the broiler industry to send a few selected men over to America to learn what grading really is and to spread that gospel widely on their return. An idea of the inadequacy of British grading techniques can be gathered from the fact that the entries at one trial of broiler stock were said by the processor to be so uniform that grading was not possible, but to the eye or to handling of the living birds there were considerable differences between and within entries. Only sound and strict grading will ensure a product that will command confidence either at home or abroad.

Experimental Horticulture

A new publication, *Experimental Horticulture* No. 1 has just been issued by the Ministry of Agriculture (H.M.S.O., price 3s. 6d.—3s. 10d. by post). This and subsequent issues, which will be made as required from time to time, will place before commercial growers and horticultural advisers accounts of the experimental work being carried out at the N.A.A.S. Experimental Horticultural Stations and by the county and other advisory officers of the N.A.A.S.

When the N.A.A.S. was set up in 1946, it was recognized that it could only link the research worker and the farmer effectively if it had adequate facilities for field experimental work. There are now six experimental horticulture stations, with a few substations, in England, and three stations in Wales. One more experimental station will be established in East Anglia.

The sites of the stations have been chosen for their climate and position in relation to important areas of horticultural production and the location of the main research stations. Soils vary from station to station, but many are representative of the soils bearing horticultural crops in the area in which the station is situated.

Each station is directed by a senior horticultural officer, who is advised by a committee which includes the directors of the research stations studying similar problems, local growers, and representatives from the N.A.A.S. The chairman is usually a prominent member of the industry, and the vice-chairman is the Regional Director, N.A.A.S., or his deputy. The committee helps the station director in the general management of the station, and draws his attention to any local problems of interest or concern which require investigation.

The experimental horticulture stations are equipped for full-scale commercial operations, and are well placed to undertake long-term husbandry experiments on a full practical scale, which it would be difficult to accommodate on growers' holdings. One of their important functions is to extend, test and interpret the findings of research on a commercial level of operation and under a wide range of climate and soil conditions.

Little Things that cause Accidents

J. C. GOUGH, M.I.B.A.E.

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Do you know that records show the amount of time lost by agricultural workers who received accident benefit from the Ministry of National Insurance in the year 1954–55 amounted to a little over half a million days? There is no record of the minor accidents or of the time lost by self-employed people when they get hurt, but clearly the total time must be staggering. Preventing accidents is largely a matter of common-sense precautions and of taking thought about everyday things—often little things. Many may think that if they faithfully carry out the requirements of the Safety Regulations no further thought about safety is needed. But that is far from being the case. To reduce the number of accidents, everybody on the farm should get into the habit of forethought.

Sharp implements, such as forks or cutting tools, left about where they may fall or be trodden on can cause injuries, sometimes serious. Hooks, hedging and other small cutting tools are less likely to fall and hurt someone if they are hung, or stood on a ledge, low down. Tall things like forks, slashers or mower knives are best kept in a rack; even leaning them in a corner is better than leaving them upright against a flat wall of a building where people pass by.

Rubber boots are in use almost every day, but rubber slips on a wet surface. Boots with soles that have a good rough pattern or are well ribbed will give the best grip, even on a concrete floor that has just been washed down. Soles worn smooth are almost as slippery as skates on concrete which is greasy with mud or dung.

During the winter artificial lighting is indispensable in and around buildings. If you are using oil lamps, remember that they give off heat and so don't put them down near dry or combustible material. Place or hang them where they are not likely to be knocked over.

Where electric lighting is available, there is often a temptation to run an extension to give light temporarily in some dark corner, perhaps for a special job, but an odd length of flex which trails across the floor, or perhaps tacked to the wall, and the end carrying the lamp then flung over a metal bracket or nail is *very dangerous*. Properly insulated, safety types of inspection lamps are available which, used with good quality cable, are safe if kept in good condition. Never use any extension light unless the bulb is protected by a wire guard. If an unprotected bulb receives a knock and breaks, someone may get a bad shock; there have been a number of such cases.

Wherever an extension must be made to an electric installation, get expert advice or help, use good material, and choose reliable appliances suitable for the job you want them to do.

It is the little things which, if forgotten, can cause injury (even fatal injury) and loss of time.

The Formosa Lily as a Commercial Crop

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A lily which will flower under glass in eight months from seed is a new commercial crop in Kent.

THE alpine Formosa lily, which is now usually known as *Lilium formosanum* var. Pricei, produces a white flower 6 inches long on a stem of 2½–3 feet. The purple markings on the reverse of the flower are well defined, though the intensity of the colour decreases under glasshouse conditions. It appears to be quite hardy in Kent, and is established in beds between the glasshouses at Wye College and in local gardens and woodlands. Since its introduction it has been recognized as a useful plant for cultivation under glass, and during the last five years it has been grown here as a commercial glasshouse crop.

The outstanding advantage of this species as a lily for commercial production is that it may be treated as an annual, flowering about eight months after the seed is sown. Thus there is no heavy outlay on bulbs, no problem of bulb storage and the stock remains free from virus disease.

In the Horticulture Department at Wye College seed is sown in heat in mid-January at the rate of about twelve seeds to a six-inch pot. The compost used is John Innes No. 1. There is adequate bench space in the propagation houses at this time of the year, and the pots are moved out before tomatoes and other young plants require all the available space.

The seedlings are moved to the flowering house in mid-March and are stood out pot thick on ground from which the corms of the freesia crop have been lifted. At about this time the seedlings are thinned to three per pot and thereafter require no attention, except for general maintenance. No staking or other form of support is required.

Flowering starts in early August and continues through September. Each stem bears a single bloom only, which makes this a convenient lily for bunching and packing for market.

Before the flowers are cut the anthers are removed; this must be done before the pollen is shed, otherwise the trumpet will show a yellow internal stain. The cut flowers are stood in water in the usual way, bunched in sixes and packed three dozen to the box, each bunch with a fold of blue paper separating it from its neighbour. The stems are made firm with a cross-stick.

During the three years 1954–57, the average price per bloom has been 8*d*. and the average yield 10,500 blooms from a 100 × 30 feet house. This return of £350 gives a revenue of rather more than £1 per square yard.

When the pots are knocked out at the end of the season the bulbs will be found to be small, not more than ¾-inch in diameter. These are usually thrown away, but some may be planted in outside beds in November. Bulbs planted at this time will flower in the open in August and September of the

Formosa lilies displayed and packed for market.

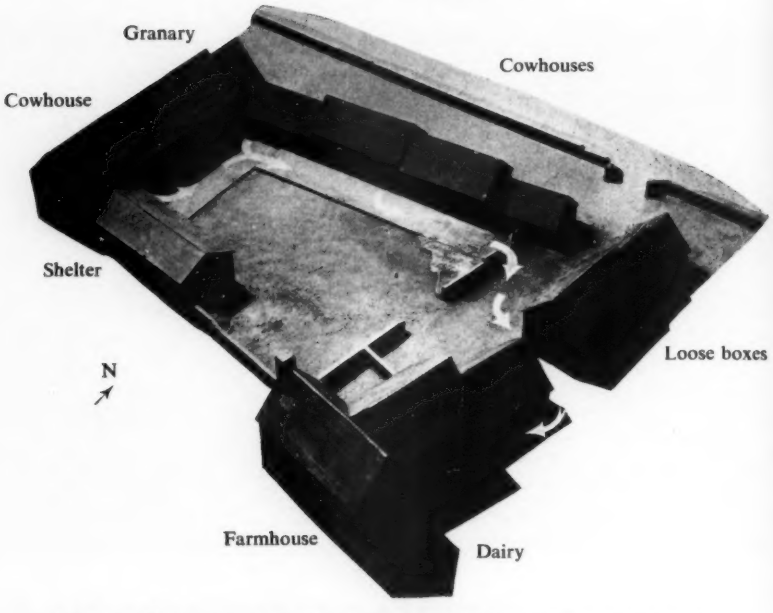
It has been difficult to obtain mildew-resistant wheats, but some success has been gained from some of the more primitive species of wheat. The picture above shows a susceptible variety (*left*) and a resistant hybrid (*right*).

Yeoman is a variety of wheat susceptible to eyespot, and the picture on the left shows infected plots in front of the marker, with non-infected plants behind.

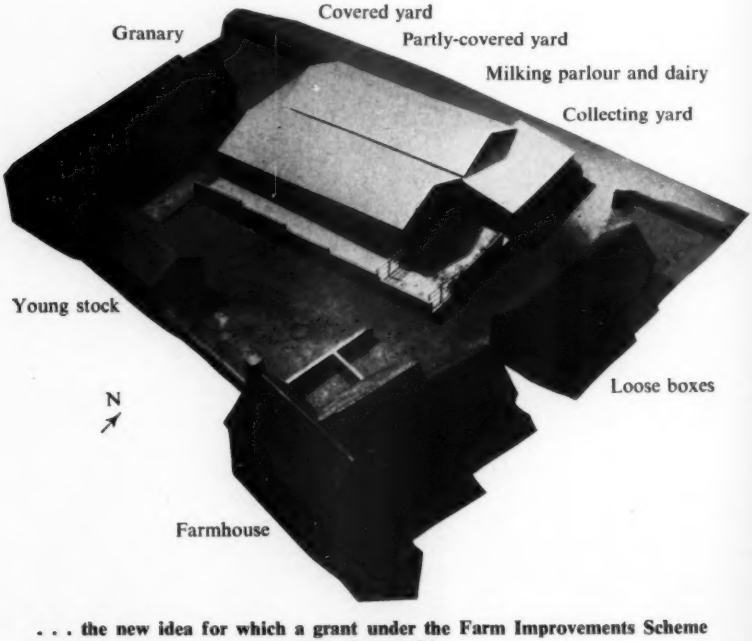
Five physiologic races are used at the Plant Breeding Institute for testing the yellow rust resistance of breeding material. Our photograph (*above*) shows seedlings being tested for disease reaction.

Eyespot causes considerably less damage to Cappelle than to other varieties. There is little sign of the disease in the infected plot (in front of the marker) shown right.

Tong Norton Farm



Model of the farmstead as it is, showing the old inconvenient layout, and . . .



. . . the new idea for which a grant under the Farm Improvements Scheme is to be sought.

following year. The flower stems will bear up to five blooms showing a more intense purple coloration on the reverse than those grown in the warmer conditions of the glasshouse. Such blooms are, however, more difficult to pack and are less in demand in the markets than the singles.

The stock of *L. formosanum* var. Pricei grown at Wye has been developed from a small quantity of seed given to the author ten years ago by the late Mr. Fred Rose, V.M.H., who had obtained his stock from the introducer, Mr. W. R. Price. Since this stock came to Wye, plants chosen for strength of stem and flower quality have been selected each year and saved for seed. The capsules ripen in October, and each contains an average of 1,300 good seeds. There are about 13,500 seeds to the ounce.

Remodelling of Tong Norton Farm

A Proposed Farm Improvement Scheme

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A plan for a new layout aimed at more efficient milk production on one of Lord Bradford's farms is to be submitted for a grant under the Farm Improvement Scheme. Photographs of models illustrating the present arrangement of buildings and proposed alterations are shown opposite.

TONG Norton Farm, on Lord Bradford's estate, is situated about a mile north of Tong village, near Wellington, Shropshire, and most of its 170 acres of lightish land lie on the west side of A.41, one of the main roads from Birmingham to Birkenhead. The late tenant, who was a member of one of the oldest families on the estate, died recently at the age of nearly ninety, and the farm became vacant. Lord Bradford, as he explained on the first B.B.C. television programme for farmers on 3rd October last, intends to take the opportunity of remodelling the farm and submit his proposals for grant under the Farm Improvement Scheme.

In planning the reorganization of the farmstead, one of the first considerations was the position of the existing farmhouse and buildings in relation to the land. Apart from other internal farm traffic, cows going to and from the milking sheds had to traverse a stretch of busy road, and then turn down a side road for a further 200 yards to the buildings. Some adjustment with the adjoining farms to overcome this difficult journey was considered by Lord Bradford and his agent Mr. S. Egar, but there was no practicable solution. The farmhouse and the main part of the existing farm buildings, together with the roads and services, were much too valuable to justify rebuilding the farmstead on a more suitable site. Moreover, the cost would have been quite uneconomic. But if this problem could not be entirely solved, it could be eased. The link between the two parts of the farm has been localized to a single point in a straight stretch of the main road where the visibility is good

on both sides. Here, stock and internal farm traffic can cross directly over the road and complete the journey to the farm buildings along the edge of a field.

The present buildings at Tong Norton are typical of the older farm buildings in the area (see photographs). They are built of brick with tile roofs in the shape of a U open to the south. The house adjoining the farm buildings has recently been modernized, and one of a new pair of cottages has been added to the farm, so there is no housing problem, but the farm buildings when regarded from the viewpoint of efficient production, are a vital one.

Old difficulties . . .

Thirty cows used to be milked in three separate sheds, and the milk then carried a considerable distance in the open, down a slope to a dairy situated at the back of the farmhouse. The full churns had, in turn, to be wheeled back up the slope to the roadside for collection. Although the granary and food room was fairly near the milking sheds, access was not good, and feeding cows in three separate groups was not economical of labour. The Dutch barn and implement cover on the opposite side of the lane to the main farm buildings was fairly conveniently placed in relation to the rest of the farmstead. One thing did help the planning of the new buildings, and was a blessing in disguise. The back wall of the range of buildings forming the bottom part of the U had been built on a dry stone wall which had started to fall in places, and as the structural timbers of the roof were coming to the end of their useful life, it was agreed that this range should be demolished. Had it been in good condition, the general problem would have been more complicated, as the building area available was small.

. . . solved by modern methods

The plan provides for a new milking parlour and dairy, with an open marshalling area for the cows and two yards each to hold about 25 cows, with a central feeding passage under cover. Food preparation and storage is to remain in the present position (the existing granary fits in well with the new buildings) and the remainder of the old buildings are to be adapted for calf and loose boxes. The Dutch barn is to remain; it may well be useful to store straw and cover a silage pit. Access to the barn and the adjoining implement cover is to be improved.

As the site of the new yards is fairly sheltered, it is proposed to have one of the yards with an open front and open concrete forecourt. The cost will be less than a completely covered yard, and as the open side will face slightly east of south, the yard should have a fair amount of direct sunlight. This partly open yard is to be about 18 feet deep, which is about the minimum depth for adequate shelter, and the concrete forecourt is to be about 20 feet wide. The fully-covered yard is about 33 feet wide, and the whole yard block is closed in on the north and west sides with sheeting above 6 feet high walls. This should preclude any risk of cross draught, particularly as the milking parlour closes in the major portion of the east end. The suggestion is to build the yard in two 33–35 feet spans of standard Dutch barn units 9–10 feet to the eaves in reinforced concrete, steel or timber, as this is the

most economical form of cover. A section taken across the yards will be (sizes are approximate) 18 feet open forecourt, 18 feet cover with 2½ feet wide manger, 8 feet central feeding passage, 2½ feet wide manger and 33 feet span covered yard. The length of the yards is in units of 15 feet bays, which is the usual standard. At Tong Norton both yards are 60 feet long, which gives about 120 feet length of manger space. The covered feeding passage, 8 feet wide, has ample room at each end for a tractor and trailer to turn.

Yards built in this way have no free-standing stanchions in the strawed areas; all are in walls or manger backs, so enabling the fore-mounted loader to work freely when cleaning out the yard. If the roof is built on the rigid frame ("Portal") principle, or is not tied across at eaves level, the scoop of the loader is not limited for head-room. The valley gutter between the yards could become a nuisance in time, but if valley gutters are made wide and strong enough, properly supported, and looked at fairly regularly (as they no doubt will be on the Bradford Estate), they should not prove too much trouble. It is difficult to avoid a gutter of this type in a double yard if standard farm buildings of normal spans are used.

The milking parlour and dairy are housed in a lean-to extension on the end of the fully-covered yard. The choice of parlour rests between the three-stall, three-unit tandem in L formation and a six-stall three-unit raised abreast parlour which fits slightly better into the layout. The dairy directly adjoins the road, and this is one of those happy cases where the levels are favourable to a churn stand at the same level as the dairy floor. Routeing the cows through the parlour is straightforward. There is a common collecting space to each yard to be used in turn, cows return direct to the covered yard and walk back about 50 feet along a causeway to the partly-open yard. For summer milking, the cows will go direct into the assembly area and be collected for dispersal back to the fields in an area between the covered yard and the road. They will not enter the yards at all. This leaves the yards free for other use in the summer. A new opening is to be broken through the boundary wall at the top end of the yards, which will reduce the distance from the Dutch barn and give a more direct access to the granary.

An eye to economy and maintenance

Although increased accommodation and greater labour efficiency were the main considerations in planning the new buildings at Tong Norton, economy in construction and an eye to future maintenance were also very important, as they are in all farm buildings. It is proposed to use standard frames of the Dutch barn type for the yards, since these are the cheapest form of cover. Concrete work has been kept to a minimum by using existing hard-standings where possible. The dairy and parlour, with brick or concrete block walls, are housed under a simple lean-to roof. Covering the feeding passage may be considered an extravagance by some, but when conditions are comfortable labour is more efficient, and a wide feeding passage is a useful temporary store, particularly at week-ends.

An application is being made for a grant under the Farm Improvement Scheme, and it seems likely to pass all the tests as being work which a prudent but progressive landlord would be willing to carry out, with the cost not unreasonably high in relation to the benefit to be obtained from it. There can

be no doubt that when the work has been done it will be possible to run the farm very much more efficiently. There will be accommodation for twenty or so extra cows in yards which could be put to other uses, and the farmer will find the maximum distance of the furthest cowstall to the dairy will be 25 feet and not 300 feet; the full churns will travel 15 feet on the level, instead of 150 feet up a slope; bulk feeding of the cows will be from a trailer into two banks of mangers instead of thirty different troughs spread over 200 feet; and cleaning out the yards can be done mechanically once a year instead of daily with a shovel and wheelbarrow. One does not have to be an economist or a time and motion expert to work out the advantages of this.

Spring and Summer Keep for Upland Lambs

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and
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As the milk yield of the ewes falls off, greater responsibility for good lamb production rests upon productive grazing.

OBSERVATIONS and experimental work show that most lambs thrive well on upland farms for about the first ten weeks. But subsequently the normal decline in milk yield of the ewe, maturing grass and incidence of parasites frequently combine to check progress in midsummer. It seems, therefore, that good, clean grazing is vital at three stages in the growth of the lamb, and these are:

(a) The first two to three weeks after birth, to maintain the milk flow of the ewe. It is well known that milk yield, which is markedly influenced by the plane of nutrition, is the major factor affecting rate of liveweight gain of the lamb.[1]

(b) At the stage when the milk yield of the ewe declines, which is normally from the twelfth week of lactation.[2] Lambs from then on require a nourishing food to take the place of milk.

(c) During the critical May-June period of parasitic infestation.[3]

The use of winter rye, Italian ryegrass, timely applications of nitrogen, suitable seeds mixtures and controlled grazing all contribute to the maintenance of a sequence of good keep for ewes and lambs during this important period.

Autumn-sown rye offers great possibilities on upland farms. It is the most winter hardy of all cereals, and since it can make growth at fairly low temperatures it can provide sheep grazing in March. For satisfactory wintering it should be sown in August or early September. The earlier it is sown,

the greater will be its contribution at the back-end of the year and the stronger will be the growth in the following spring.

To use the crop to the best advantage, it should not be allowed to make too much growth before grazing, otherwise the vigour is lost and recovery is slow. A system of quick grazing with rest periods gives the highest production.

Early grass

Greater use should be made of Italian ryegrass as a catch crop or in one-to-two year leys to provide the necessary early grass for ewes and lambs. All corn crops which are not otherwise sown to ley mixtures should be undersown with 20–25 lb per acre of Italian ryegrass. This will provide valuable clean autumn grazing, thereby relieving other leys, and the more forward stands can be dressed with 2–3 cwt per acre "Nitro-chalk" in early March to stimulate early growth of grass. Commercial Italian ryegrass is quite suitable for catch cropping, but if the sward is intended to remain for one to two years, S.22 Italian ryegrass and white clover should be used.

More attention should be given to seeds mixtures on upland farms. On the rotational fields, which have to provide hay or silage as well as grazing, mixtures should always contain a good proportion of the leafy strains of grasses and clovers.

On the ffridd or in-bye land, which is mainly used for sheep grazing and where sheep concentration is heavy over a long period, no ley will persist as well as that based on S.23 ryegrass and white clover.[4] The addition of a proportion of S.24 ryegrass will provide grazing rather earlier in spring, but unless cattle are also grazed in association with sheep, its inclusion will make it very difficult to control heading in late May and June.

Cocksfoot does not persist well under continuous sheep grazing.[5] Timothy, especially the S.48 and S.50 types, persists rather better, but where the management allows for intermittent rest periods, the leafy strains of cocksfoot (for example, S.143) can make an important contribution to sheep keep in summer and winter, either alone with white clover or in mixture with timothy, meadow fescue and white clover.

It has been shown that the best value from both leys and permanent grass is obtained where there is some control over the grazing animal. Continuous over-grazing and under-grazing are both detrimental to the life of the sward. Grass fields should be grazed rotationally with intervening rest periods to allow root reserves to build up for the next period of productive grazing. In this way and by balanced manuring, it is possible to maintain good pastures which provide the necessary nutritious diet for the young lambs as the milk yield of the ewe declines.

Recent work on parasitic infestation of pasture has confirmed the value of rotational grazing in the maintenance of stock health.[6] The benefit of mixed grazing, whereby cattle control pasture growth for the sheep flock, and the value of topping hardly need to be emphasized, but the absence of stockproof fences and watering facilities are serious limiting factors in the efficient use of grass on upland farms.

Where ewes and lambs are introduced into grazing which is mainly composed of young leys, the provision of a run-back on to some permanent

pasture helps to maintain the nutritional balance and to avoid sudden changes of diet.

Should the present trend towards increased stocking rates continue, the grazing management will need to be of a high order if stock health is to be maintained and deterioration of swards avoided. Regular manuring with balanced fertilizers will help to preserve the productivity and persistency of our sheep pastures.

Earlier weaning

There is a lot to be said on the upland farm for weaning earlier than is normal practice. After three months of lactation, the ewe is competing with the lamb, inasmuch as she is taking more food than she contributes through milk. This is the stage at which she could be turned on to the poorer ground (hill grazing), leaving the best grass for the lamb. Earlier weaning would appear to have several advantages which are sufficiently important to list: better grazing can be kept for lambs; better use can be made of hill grazings by stocking six weeks earlier with ewes; reduced trouble through over-fat ewes; more ewes can be carried because of the shorter period on low ground; the progress of the lamb need not be impaired by earlier weaning.[2]

The current prosperity of the sheep industry, which is due to the firm demand for good quality fat lamb, has stimulated enormous interest in the management of both flocks and grassland. If the full potential of a ewe flock on an upland farm is to be realized, old practices must inevitably give way to new.

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It is regretted that the articles on Bovine Tuberculosis Eradication in N. Ireland and Eire, announced in the January issue, have had to be held over.

Sheep Fattening on Swedes

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Liveweight gains of 12 lb per lamb have been obtained over 8 weeks from a ration of swedes plus hay, and 14 lb per lamb from swedes, hay and a cereal supplement.

In south-west Shropshire, fat lambs are important items of farm revenue. They are sold fat either straight off the ewe in spring and summer, off pastures in late summer and autumn, or off crops of rape, kale and swedes in winter and early spring. Swedes still comprise one-third of the root crop acreage and continue to make an important contribution to winter sheep feed.

The following records and observations were made on two groups of lambs feeding on a swede crop for 8½ weeks during the winter 1956–57, to measure the output of the crop when fed with or without a cereal supplement, to assess the value of the output and, incidentally, to record the effect of lameness.

Sixty lambs, individually marked and weighed, were divided into two groups of thirty animals of as nearly as possible matching weights. Each group was turned into a separately fenced area of the crop, the fence being moved forward once a week. Both groups received well-made medium quality hay to appetite, and Group A also received a ration of ½ lb per head per day of mixed cereals. The weight of the crop was calculated by a series of sample plant counts and weighings to be 19 tons of roots and not quite 5 tons of tops per acre. The amounts of hay and cereals and the area of the crop consumed by each group were recorded. The lambs were weighed individually on five occasions:

Record of growth

Average liveweight	Group A (with cereals)	Group B (without cereals)
	lb	*lb*
6 November (initially)	76·9	75·8
14 November (after 1 week)	81·8	77·0
28 November (after 3 weeks)	85·6	83·0
11 December (after 5 weeks)	88·2	86·6
5 January (after 8½ weeks)	91·2	88·1
Increase—per head	14·3	12·3
—per head per week	1·7	1·5

The lambs in Group A gained weight at a greater rate when first fed on the crop, and although Group B lambs made a slower start, they subsequently made more rapid progress up to the end of the fifth week. During the last two-and-a-half weeks of the period, both groups made slower progress; this was more marked in the lambs of Group B. Snow, followed by cold and wet conditions, prevailed during this later period.

Greater liveweight on cereals

At the end of the trial, the lambs in Group A had consumed an average of 118 lb of swedes, 6 lb of hay and 3·6 lb of cereals per head per week, while Group B had fed 124 lb of swedes and 4·9 lb of hay per head per week. The crop and supplements as recorded provided 442 sheep weeks per acre for Group A and 433 sheep weeks per acre for Group B, and the output of liveweight per acre was 754 lb and 615 lb respectively.

A calculation of the constituents of the food consumed showed that for both groups the ratio of starch equivalent to protein equivalent was 7·5 : 1, compared with a theoretically required ratio of 6 : 1. It is possible that an improved rate of liveweight gain might have been obtained, either by using hay of higher protein content (the sample used contained 8·9 per cent crude protein in dry matter), or by including a concentrated protein food with the cereals fed to Group A.

The unconsumed residue of roots was calculated by a series of sample weighings to be approximately 5 tons per acre, representing 20 per cent of the total crop and having an estimated value of £7 per acre. Cutting and pulling would reduce this loss considerably, but would cost about £7 per acre and could rarely be justified for fattening sheep.

At the final weighing, 39 lambs which were expected to provide Grade A carcasses were selected by the farmer and sold on grade and deadweight. All 39 were graded "A". The remaining lambs were valued at the current deadweight prices, less 1*d*. per lb for the estimated dressed carcass weight.

Liveweights, dressed carcass weights and net prices or valuations

	Group A	Group B
Number graded	21	18
Initial average liveweight (lb)	78·8	76·6
Final average liveweight (lb)	93·0	90·1
Average dressed carcass weight (lb)	44·6	42·5
Dressed carcass weight as per cent of liveweight	47·9	47·2
Average net price realized	£7 12*s*. 9*d*.	£7 7*s*. 3*d*.
Number ungraded	8	12
Initial average liveweight (lb)	72·8	75
Final average liveweight (lb)	86·6	85·4
Average net valuation	£7 1*s*.	£7 0*s*. 1*d*.

Note: One lamb from Group A became ill and was removed from the trial during the first week.

The costs of production of the foods consumed were taken to be 29*s*. per ton for swedes, £8 per ton for hay and £18 per ton for cereals. On this basis the figures were:

Values, margins and carcass weights per acre

	Group A	Group B
	£ *s*. *d*.	£ *s*. *d*.
Value per head at beginning	6 0 0	6 0 0
Net value per head at end	7 9 6	7 4 4
Gross margin per head	1 9 6	1 4 4
Costs per head	19 0	13 10
Net margin per head	10 6	10 6
Net margin per acre of swedes (plus supplements)	27 15 10	26 6 0
Output of dressed carcass weight per acre of swedes (plus supplements)	361 (lb)	290 (lb)

The lambs receiving cereal supplement (Group A) increased in value by 5*s.* 2*d.* per head more than Group B, but since the extra cost of feeding was also 5*s.* 2*d.* per head the net margin per head was the same for both groups. But because Group A lambs consumed a smaller area of the crop, and also gained more liveweight, the net margin per acre and the output of mutton per acre was higher from that group.

Effect of lameness

At the beginning of the trial fifteen lambs were lame, and at each weighing special notes were made of these individuals. The lame lambs were treated with a knife and a proprietary foot-rot paste. Three weeks later, two of the original fifteen were still lame, and five others had also become affected: these seven were treated as before. After a further two weeks, only one lamb was still lame, and although treated, this individual remained lame until the end of the trial. In all, 20 lambs were lame for a part of the feeding period, and their average liveweight gain per head over the 8½ weeks was 9·5 lb, against an average of 15·2 lb for the 39 sound lambs. This represents a difference of 5¾ lb liveweight gain or 9*s.* 4*d.* per head at the average selling price per lb.

Summary

When used for fattening sheep for 8½ weeks during the winter 1956–57, this 19-ton-per-acre crop of swedes with a supplement of hay gave an output of 615 lb live weight (equal to 290 lb dressed carcass weight per acre) and a liveweight gain per lamb of 12·3 lb. When cereals were fed in addition to the swedes and hay, the output was 754 lb live weight (equal to 361 lb dressed carcass weight per acre) and a liveweight gain per lamb of 14·3 lb. The lambs receiving no cereal supplement suffered an appreciable check in growth when first put on to the crop, and made relatively slower progress during a spell of bad weather.

The assessment of the value of the crop showed a net margin per acre of £26 6*s.* when fed to the lambs with hay, and of £27 15*s.* 10*d.* when fed with hay and cereals. Although the gross margin per head was greater when cereals were fed (29*s.* 6*d.* compared with 24*s.* 4*d.*) at current costs of growing cereals the net margin per head (10*s.* 6*d.*) was not increased.

Flock-owners have long been aware that lame sheep do not thrive, but a loss of 5¾ lb live weight, valued at 9*s.* 4*d.* per head, for sheep which were lame for only part of the feeding period, shows the extent to which prompt attention to foot troubles can pay dividends.

Month in the Forest

J. D. U. WARD

Fire scorch—History in the trees—Forests of the future

THE February fill-dyke alliteration commends itself so strongly to country minds that millions of the careless and uncritical are fixed in error for life—from earliest childhood. On average, February and March are among the four driest months of the year—except perhaps in Penzance. From that fact, combined with the state of much vegetation and the work done at this season, arises the increased risk of fires. March has the distinction of being the worst month of the year for forest fires, but a slightly different aspect merits comment here. Few "non-tree" people appreciate the danger of scorch injury to trees, and the point needs watching whenever large hedge trimmings and (particularly) orchard prunings are being burnt. Some trees with thick bark, such as oak and redwood, will resist heat better than others. But, broadly speaking, all trees are vulnerable to scorch, and this applies particularly to thin-barked kinds such as beech, ash and most conifers. The scorched tree probably won't be killed and may show no obvious sign of damage (at least, not for a few years), yet a carelessly placed fire or disregard of a shift in the wind may mean £10–20 worth of damage.

While looking round the park and private woods of a great estate the other day I was interested once again to notice how history is reflected in the trees and planting. Few people appreciate that this island has only five species of indigenous trees which habitually reach over 50 feet—oak, ash, beech, elm and Scots pine. All the others are introduced, or "beastly aliens". Possibly the earliest introduction, belonging to Roman times, is the sweet chestnut, which in Britain is well north of its natural latitude. The Norway spruce or Christmas tree was probably reintroduced 400–500 years ago. The European silver fir was brought in about 1610. This last is an interesting species, of considerable value in Continental forestry and in this country often providing "the tallest tree on the estate" (or even in the county), growing to anywhere between 125 and 175 feet. Quite a few of these old silver firs survive, usually flat-topped, but the species is now little planted because it is so susceptible to attack by a minute insect (adelges). Efforts are being made to find resistant strains, but for the present foresters normally prefer the rather similar American silver fir, *Abies grandis*, introduced from Western America in 1832. This is a vigorous, fast-growing tree, quite often making four feet a year. (The champion for Britain is now about 170 feet; a Douglas fir, of 180 feet surpasses it, however.) But *Abies grandis*, which is grand in appearance as well as name, is emphatically a moisture-lover and thus does better on the western half of England and Wales.

The horse chestnut and the European larch are both presumed to have arrived in Britain about 1600–30. The former comes from Northern Greece and is primarily a decorative tree. Its timber is white and was once used for kitchen and dairy utensils; it is still recommended for fruit racks and

trays, but is of small value. There is, however, the possibility that it may have some future for pulping and shredding purposes. European larch has done handsomely for many estates, but has now been superseded in too many places by Japanese larch which was introduced in 1861. Japanese larch is fast-growing, but weaker and less particular about site and soil than European larch.

A valuable, quick-growing tree which prefers the drier side of England is the Corsican pine, introduced in 1759. This has some similarity to the ordinary Scots pine but is not orange or red in the bark and its needles are longer, more grey-green (rather than bluish) and more inclined to twist. It has a good reputation for wind-firmness. About the same time (probably in 1758), we received our first Lombardy poplars which are so well known. Nearly but not quite all Lombardy poplars are male trees. Their timber is not thought of highly, but the trees are quick growing and useful for making screens. The poplars which are so often recommended as "farmers' trees" are of more ordinary form, and some of them are relatively modern hybrids, bred in the last seventy years from crosses of American and European parents. The timber includes, among its many uses, matchsticks and punnets.

A protracted catalogue of trees would be tedious, but some knowledge of their history and of fashions influencing planting (for example, avenue-planting which was specially fashionable 1660–1740 and again in Victorian times, and Capability Brown's landscape gardening and clump formation about 1760–80) adds greatly to the interest of a rural landscape and to the understanding of parks and woods—and, not least, to what is happening in our own time. The major introductions from Western America between 1825 and 1855—Sitka spruce, Douglas fir, "macrocarpa" and Wellingtonia are four that everyone knows and can see almost anywhere—have had a marked effect on the appearance of the wooded areas of our countryside, especially since 1919.

The rather long time-scale of tree life and of forestry makes the changes slower and less obvious than, for instance, is the case of the passing of farm draught horses in favour of tractors or the fewer stooked cornfields because of the combine harvester's success. But the silvicultural changes are there nevertheless, written into the landscape, for whoever can read them.

I have not been able to solve a certain small winter problem. When working with a gang with billhooks and axes, I noticed that in really sharp weather the frost was always warmed out of the steel by a small fire before a start was made. Now as my boss and I did nothing of the kind when we were working in Canada in much lower temperatures, I was moved to consult a minor expert on the subject and he said that he did not think English winter temperatures could affect hooks and axes. Could this mean then that the "warming of frost from the steel" was really an excuse for hand-warming and delaying a start?

Farming Affairs

The new Minister of Agriculture

On 7th January, 1958, the Rt. Hon. John Hare, O.B.E., M.P., succeeded the Rt. Hon. D. Heathcoat Amory, M.P., as Minister of Agriculture, Fisheries and Food, when Mr. Heathcoat Amory became Chancellor of the Exchequer.

Mr. Hare, the third son of the fourth Earl of Listowel, was born on 22nd January, 1911. He was educated at Eton and after leaving school went into business.

In March, 1937, he was elected an alderman of the London County Council—at 26 one of the youngest men to have had that honour.

His political career was interrupted by the war, in which he served with distinction. He was mentioned in despatches, awarded the O.B.E. and the U.S. Legion of Merit, and left the Army with the rank of lieutenant-colonel.

In 1945, he returned to politics, flying home from Italy to win Woodbridge for the Conservatives in the General Election. In 1950 he was returned to the Commons for the then newly-constituted division of Sudbury and Woodbridge, which he has held ever since. The following year he became Vice-Chairman of the Conservative and Unionist Party, and from December, 1955, until October, 1956, he was Minister of State for Colonial Affairs. He was appointed Secretary of State for War in October, 1955, and held that post until he became Minister of Agriculture.

Mr. Hare farms 580 acres at Cottage Farm, Little Blakenham, near Ipswich. The farm is a mixed one, and carries a herd of 55 attested Guernsey cows, some Large White pigs, and poultry. Sugar beet, cereals, peas and root crops are grown, and 20 acres are devoted to apples and plums.

At the Farmers' Club

Quality as the Basis for the Farmers' Choice of Seeds

For efficient crop production, a farmer requires clean, viable seeds, free from harmful weeds and seedborne diseases, seeds which will produce the maximum yield of the type or variety of plant best suited to his farming conditions. At the Farmers' Club on January 8th Dr. P. S. Wellington, who

is Chief Officer of the Official Seed Testing Station for England and Wales, explained how the recommendations of the Committee on Transactions in Seeds are designed to help farmers recognize and choose the best quality seeds, and may also stimulate home seed production and export.

Present legislation has brought high standards for seed sold through merchants. But the standard of seed saved for farm use appears to be less satisfactory, for 26 per cent of the cereal seed samples sent to the Official Seed Testing Station by farmers in 1955–56 failed to attain the normal standard of germination, and in the following year 45 per cent failed. Only 10–20 per cent of the samples submitted to the Official Station came from farmers. "Clearly," said Dr. Wellington, "there is a need to persuade farmers to have their seed tested, especially when they have cleaned it themselves or have stored it on the farm for a considerable period." The Committee has recommended that buyers should be told the percentage by weight of the total weed content, and the number of seeds of wild oat, dock and sorrel, black-grass, couch grass and dodder present in a specified quantity of seed, and that seed with over 3 per cent (by weight) of weed seeds should neither be sold nor sown. At present, full details of the weed content do not have to be declared to the buyer, who is not, therefore, always in a position to judge the degree of field contamination which might follow from the presence of even a very small proportion of weed seeds. Docks, particularly noxious in grassland, were prevalent last year in imported cocksfoot and timothy seed: 46 per cent of Canadian and 96 per cent of Finnish timothy contained dock and sorrel seed, though 99 per cent of these samples were rated above 98 per cent for purity. British seed, though purer, had lower germination.

To promote the wider use of improved varieties and so exploit the work of plant breeders, trials organizations and advisory services, the Committee considered that buyers should be given information about variety, type and country of origin of seeds.

High quality also implies freedom from pests and diseases. Routine use of seed dressings has eliminated all the common seedborne cereal diseases in Britain except loose smut of wheat and barley, and these are controllable by growing resistant varieties or using healthy seed. "But," said Dr. Wellington, "there is an urgent need for present treatments to be more widely applied, and it is not therefore surprising that the Committee has placed most emphasis on the dissemination of advice about incidence, detection and treatment of seedborne diseases." New treatments, such as fumigation against eelworm, are also needed.

The adoption of new varieties has been swift where high quality of seed is clearly linked with profitability, as is the case with cereals. Continued emphasis on home-produced feedingstuffs will inevitably stimulate demand for higher quality seeds of herbage and fodder crops.

Our variable climate causes most of the problems of home seed production. It is responsible for wide seasonal fluctuations in yield, germination and, it follows, price, but these difficulties could be overcome if long-term storage could be made reliable and safe.

Cold storage below 50 per cent R.H. (relative humidity) or at 6–8 per cent moisture content, might be justified for vegetable seed. For bulky seeds like grass, warehouse storage at 60 per cent R.H. would suffice. Moist seed quickly deteriorates in damp air.

The modern alternative to stacking and threshing is combine harvesting when conditions are favourable, followed by drying to condition the seed. Much more information is still required about the best treatment for individual seeds, but experience has shown that common causes of poor germination include undue delay between harvesting and drying, heating too long, the harvesting of grasses when immature or too wet, incorrect setting or excessive speed of the combine, and inadequate drying before storage.

Dr. Wellington believes that by applying present knowledge, specialized seed production could become an integral part of our agriculture, ensuring high quality seed for our farmers and enabling development of an export market where the advances made by our plant breeders could be exploited on a wider scale.

Sylvia Laverton

Talking about poultry

Among the items that always arise in February are baby chicks and dirty eggs, and perhaps we may take the egg first. Whether or no prices stay at the current level, there is no doubt that dirty eggs cost the farmer much more than he realizes. I must confess that I get some on the farm and I have been horrified when I have costed out the time and money involved in their cleaning and handling, and of course, on top of this there is a deduction if the eggs are stained or improperly cleaned. The fact must be faced that dirty eggs are essentially a management problem, and not one which the operator can thrust off on somebody else. To keep on top of this, we must try to keep the litter dry and the birds' feet clean, allow plenty of nest-box room, and have the nests in such a position that the birds will use them and not be tempted to lay underneath.

When birds are housed intensively, the most common cause of the really dirty egg is floor laying. This depends on several practical factors, but one of the most important is the distance the birds have to walk to find a nest. I find that they are prepared to walk about twice the width of the house, but not a lot more. Floor laying in intensive houses is aggravated by morning lighting and the fact that the eggs may be laid several hours before the attendant arrives.

Where birds are housed outside, the two factors that have helped most in my experience have been the provision of something which the birds have to pass over and clean their feet on, and the use of stiff non-resinous woodshavings or chippings as nest material. While on this subject, I should mention that against my personal feelings, we have been using a dry cleaner on our eggs. This is of the cloth, emery, buffer wheel type, and I have been most impressed by the way in which the job has been done, and by the general finish of the sample. Such a machine is useful for removing trap nest numbers from the egg. I do not suggest that it is perfect, but the system is obviously the method of the future.

There are three important aspects of the February chick—the feeding, warmth and space. Obviously the feed must be fresh, and it is silly to try to use up any odd bits that may have been left over from the October/November hatch groups. Again, there must be adequate trough space, and I like to start them with a few handfuls in one of their chick box lids. I also like to keep the narrow end of the trough towards the heat, as when the trough is broadside on, the chicks on the far side may not see or feel the heat and may

go in a huddle. Warmth and space go together, especially in February, because one never knows what the temperature or weather conditions are going to be. The answer here must be to have plenty of heat under the brooder and space around it so that the chicks may get away as and when they want. Such a provision will cover a sudden change of temperature, without making a lot of unnecessary adjustments to the heating apparatus.

C. T. Riley

Tractor sense

Additional models of tractors were introduced by several of the major manufacturers during the last weeks of 1957, and a very wide range of sizes and powers is now available. All models incorporate the improvements which have been brought in, almost unnoticed, during the past few years, and which make tractors the most versatile of all farm tools. The most outstanding of these improvements is probably the greater number of gear ratios, with which it is easier to select the best forward speed for the operation and to make fullest use of the engine power.

This new feature is so important that it may well affect the established ideas of how large a tractor is needed on a given farm. Possibly a smaller tractor can now do as much work in the year as a larger one could when tractors had only three or four gears. But some basic factors remain, and we must not cut the calculations too fine when deciding what power of tractor to have. This should be particularly remembered when the farm is to be run by one tractor only, because there is no good sense in scaling down the size of implements to fit the size of farm. A piece of equipment that is too small wastes manpower, and on a family farm, for instance, the labour of the owner should be valued even higher than the labour of a tractor driver on a large farm.

There are some jobs, such as inter-row hoeing, which take little power and can be managed just as well by a small tractor as by a large one, but in spite of the great versatility of the modern tractor and the many jobs to which it is put, ploughing remains the operation which the one-tractor farmer ought to have in mind when he is deciding what size of tractor to order. There are only a certain number of days in the year for ploughing, if the later operations of seedbed preparation and drilling are to be done with the timeliness necessary for the best results. Therefore it is most useful to find how many hours a given size of tractor will take to plough a certain acreage. This can be done from data in the sales literature of the tractor manufacturers, who generally state the number of furrows which their tractor can be expected to pull, and often supply, or approve, a certain size of plough to match each of their tractor models. We can assume that, on all but the heaviest land, the plough recommended can be drawn at two miles per hour at the depth required. Sometimes the manufacturer gives a figure for drawbar pull instead of plough capacity. If so, we can convert it to plough capacity by reckoning that a pull of 500 lb is needed for a ten-inch-wide furrow drawn at six inches deep on light land, 700 lb on medium land, and 900 lb on really heavy land. Therefore, a three-furrow plough on medium land will need a pull of about 2,000 lb if the furrows are drawn six inches deep.

To find the number of acres we can manage, multiply the speed per hour by the width of the bout of work in feet and divide the answer by ten. The resulting figure for acres per hour will include the time spent turning at the

headlands and in making openings and finishes. If we are calculating for a three-furrow, ten-inch plough, we shall multiply 2½ feet (three ten-inch furrows) by two and divide by ten, and get a figure of half an acre per hour. From that we can work out how long all the ploughing on the farm would take.

The above calculation does not take account of any lapses on the part of the tractor. The slip of driving wheels can reduce the speed, and the heavy rolling resistance of wet and sticky soils can reduce the useful power output. Neither does it take into account the fact that the tractor will not always remain in the good condition of the specimens tested by the manufacturers when they worked out the figures in the sales literature, so it is well to allow a latitude of perhaps 20 per cent in the calculation.

It is better to have a tractor that is too large: one that is too small can bring disaster to a year's farming, whereas one that is too large can do little worse than tie up more capital. The depreciation and repairs on a large tractor are not much greater than on a small one, and the fuel costs also are very little different, because modern engines are reasonably efficient even when they are running at considerably below their full power output. A few years ago it was worth having a small tractor just because it was handier to operate than a large one, but modern large tractors, with motor-car type steering and controls, are just about as easy to control as small ones.

H. J. Hine

World meat

World meat production continues to rise. The output in 1956 was nearly 50 per cent above the pre-war level. International trade was, however, only 2 per cent higher than in 1938. This information is given in a review of meat production, trade, consumption and prices compiled by the Commonwealth Economic Committee.*

The expansion in recent years has been chiefly in beef. Among the factors contributing to this increase has been the declining importance of calf slaughter, which nevertheless remains substantial in many countries. Pig-meat output has continued to rise from the low level of 1953, following heavier production in North America. Mutton and lamb declined in 1956 for the second year in succession.

World exports of carcass meat rose sharply in 1956 and were slightly greater than before the 1939–45 war, with those of beef and veal reaching a record level. Once again, Argentina was the world's largest exporter of meat and the United Kingdom continued to be the principal market. Exports from Commonwealth countries, which account for two-fifths of world trade, fell slightly, although Australia and New Zealand have shared in the rise in beef exports to Continental European countries and have also shipped appreciable quantities to new markets, such as Japan.

In most countries, total consumption of carcass meat is far greater today than it was before the war, but this increase has not been fully matched in consumption per head terms, owing to the large increase in populations.

Indications for 1957 are that the upward trend in world meat production has been checked, but that international trade has been well maintained.

* *Meat, 1957*. Commonwealth Economic Committee. Obtainable from the Committee at 2, Queen Anne's Gate Buildings, Dartmouth Street, London, S.W.1., or H.M. Stationery Office, price 5*s*. (5*s*. 9*d*. by post).

In Brief

EUROPEAN FREE TRADE AREA

"The Free Trade Area proposals need not frighten the farming community. Right from the start the Government have insisted that we shall not enter into arrangements which involve free trade in foodstuffs into this country. We have said that we must be free to honour our obligations to our farmers and horticulturists, and also to our friends in the Commonwealth. Only last month the Prime Minister, at the Farmers' Club dinner reaffirmed that the Government intends to maintain that position.

"You may like to know what is proposed by way of agreement on agriculture among countries who may take part in the Free Trade Area. What has been suggested by us is an agreement for ways of developing and strengthening the existing methods of co-operation in agricultural matters. We already have discussions on these subjects among the countries of Western Europe each year in Paris. It is common sense that we should inform one another of the reactions which our agricultural and trade policies may have.

"I think we can all agree that it would be folly for the countries of the free world not to have some regard for the effect on others of their home policies. But it must be clearly understood that we are not letting control of our own home agricultural policy out of our hands. There is no question of accepting decisions on this from other countries. Full consultations and discussions with our neighbours is a totally different thing. I hope what I have said will dispel any anxieties you may have felt on this subject."

Mr. John Hare, Minister of Agriculture, speaking at Ipswich on 14th January, 1958

GRASS INSTEAD OF CONCENTRATES

"Output of grassland in this country can be substantially increased—certainly by as much as one-third—from its present relatively low level. Such an increase could provide sufficient feed to support a cattle and sheep population some 25 per cent greater than the present one and in addition permit a saving of some £50m. in the United Kingdom's current bill for imported feedingstuffs."

So writes Mr. R. A. Hamilton in the Agriculture Supplement of *The Financial Times*, issued at the end of January. He quotes as an exemplar a 40-acre grass farm in Wales, which carries a Friesian herd producing an average of 1,100 gallons of milk per cow per year. (The average cow in the national dairy herd produces under 700 gallons.) "The total cost of all-the-year-round milk production on the Welsh farm averaged only 1s. 11d. per gallon, compared with about 2s. 6d. on many farms. This low cost was achieved by feeding only 2 lb concentrates per gallon, compared with nearly double this level on many dairy farms, the remainder of the feed being grass—as grazing, hay or silage."

PEDIGREE CATTLE BREEDING

Mr. Robert Adam, a farmer and pedigree stock breeder from Glamis, Angus, spoke about his experiences at the British Cattle Breeders' Club Annual Conference held in Cheltenham on January 13-16. Pedigree breeding is not, he said, as one often hears, a game for rich men only, but it should be done by those who have the flair for it. "I started in a very small way, buying my first Aberdeen-Angus female with school savings. Any profits were ploughed back, and it is wonderful how a herd can be built up. When one starts, as most of us do, with

limited capital, a good plan is to study the mating results of other breeders. A great deal of cheap experience can be got from this. Study the breeding programmes of the master breeders, and also those who have failed—both have a lesson to offer."

The selection of a new stock bull is a tricky job, and if successful breeding is to be established over a period, a line-breeding policy must be followed—a point which adds to the complications of selecting the right kind of sire.

"I cannot tell you where line breeding starts and sub- or in-breeding stops", said Mr. Adam, "but I am certainly not in favour of father on daughter, son on mother, or full brother and full sister matings. Half brother and half sister—that is, by the same sire from different female lines—can be very successful, and that is as close as I like to go. A cow mated with her grandson can be all right, as can a male and female with the same two top sires, provided again that the female lines are different." And really outstanding animals are essential if a line-breeding policy is to be successful. Bad characteristics are as easily bred as good ones.

HUMANE TRAPPING

After 31st July this year the use of gin traps, described by the Committee on Cruelty to Wild Animals as "a diabolical instrument which causes an incalculable amount of suffering," will be illegal. The Humane Traps Advisory Committee considered nearly 200 designs of traps over the past three years before making their recommendations.

The following seven are now approved for use in England and Wales, under the Spring Traps Approval Order, 1957: the Imbra Traps Mark I and Mark II and the Juby Trap for killing or taking rabbits in rabbit holes and for killing or taking grey squirrels and stoats, weasels, rats, mice or other small ground vermin in artificial tunnels constructed for the purpose; the Fenn Vermin Traps Mark I, II and III for killing or taking grey squirrels and stoats, weasels, rats, mice, or other small ground vermin in artificial tunnels set for the purpose, or for killing or taking rats and mice in the open on their runs; the Fuller Trap for killing or taking grey squirrels.

The Imbra Mark I, the Fenn Vermin and the Fuller Traps are already in production and on sale. It is anticipated that supplies of the Imbra Mark II and the Juby Traps will be available in the spring. Demonstrations of these traps will be arranged by the Ministry's pests staff in England and Wales.

Another Order entitled The Small Ground Vermin Traps Order, 1958, has been made which permits the continued use of all breakback traps used against rats and mice and also of spring traps used for catching moles in their runs.

THE SHAPE OF PLANTS TO COME?

Very small but regular doses of a newly-discovered growth hormone, gibberellic acid, will make some plants grow 50 per cent taller and have longer (but sometimes fewer) side shoots and bigger leaves. Roots are not stimulated: in fact too big a dose will stunt them, even while producing over-long stems.

Many different plants have been tested to see which respond and in what way. Wheat treated in spring grows quicker at first, but does not yield more grain or straw. On the other hand, grass sprayed with 2 oz per acre, and cut 4-10 weeks later, yields 2-8 cwt per acre more dry matter and therefore a worthwhile increase in protein, though at the expense of later growth.

Lettuce for seed can be made to flower early; so can biennials such as carrots and some brassicas, even without the short cold spell which they normally need.

Dormant potato tubers will sprout if soaked in a solution of 25 parts per million of gibberellic acid in water.

It must be added that gibberellic acid has some undesirable characteristics and there is, as yet, little knowledge of whether treated food plants are made unsafe or inedible, but its practical value—even exciting possibilities—should become apparent in the next year or two. Some compounds containing it are already on the market and will perhaps be most useful for increasing grass production and hastening flowering and seeding.

Mr. J. B. E. Patterson gives a more detailed account of gibberellins and gibberellic acid in the winter 1957 issues of the *N.A.A.S. Quarterly Review*.

GREATER USE OF FERTILIZERS

Farmers in the United Kingdom spent £86½ million on fertilizers in the financial year, 1956-57—over ten times as much as they spent on them just before the war. In terms of NPK, consumption in 1938-39 was no more than 305,000 tons, but in 1956-57 the figure rose to 989,000 tons. The increase was mainly in nitrogen—about five times as much. The use of phosphate has been little more than doubled.

WEEDS IN SUGAR BEET

New ideas about weed control in sugar beet have been tried out at the Norfolk Agricultural Station, Sprowston. An absorbent carbon layer between the seed and the herbicide has been sprayed to protect the seedlings, thus enabling a higher rate of chemical to be used without damage to the crop. The pre-emergent chemicals chosen for this experimental work were propham, CDEC and endothal.

Propham has continued to give good results and endothal is promising. The latter is not a new chemical, but its testing has been held up in this country on medical grounds and has only recently been declared suitable for field use.

VIRUS YELLOWS IN SUGAR BEET

The use of systemic insecticides to control yellows in sugar beet increased the yield of roots by up to 4·5 tons per acre in 1957, said Mr. F. C. Bawden of Rothamsted Experimental Station recently. Their value depends on applying them soon enough to kill the first aphids that arrive in a crop. They will not wholly prevent the virus from being brought into a crop, but they greatly delay its spread within it. All the sources of infection for the unprecedently early outbreak in beet in 1957 are not known, but near the coast wild beet was almost certainly an important one. There seems some hope of breeding varieties more resistant than those now grown, and inbred lines selected at the Rothamsted Field Station at Dunholme out-yielded commercial varieties by more than a quarter in places where yellows was severe.

TAIL-PIECE

Ever since March 1953 the grey squirrel has had a price on its tail. Since that time nearly 1,315,000 squirrels have been killed, of which bonus claims were paid on about 1,137,000 tails—the cost, some £80,000.

The Forestry Commission have, however, now announced that this bonus scheme will be discontinued at the end of February. But in the interests of the well-being of agriculture and forestry it is hoped that, despite the absence of monetary reward, the grey squirrel will continue to be recognized for the pest that it is and accordingly destroyed.

Book Reviews

English Peasant Farming: The Agrarian History of Lincolnshire from Tudor to Recent Times. JOAN THIRSK. Routledge and Kegan Paul. 40s.

The primary title of this book is misleading. It is really a history of farming in Lincolnshire, and it includes in its scope landlords, yeomen, capitalist farmers and labourers as well as peasants. In character, it is a detailed, systematic and scholarly work—the author is Senior Research Fellow at the University of Leicester and is now preparing the first volume of the new agrarian history of England. In presentation, it wisely obeys the rulings of geology and follows the separate fortunes of Lincolnshire farming in fen, marsh, upland and clay. It is, in fact, not a regional study but four regional studies; and the tale they combine to tell is fascinating.

Basically, the theme is one of challenge and response, of the manner in which certain farming communities adapted themselves over the generations to changing circumstances. The exploitation by coastal parishes of the natural process of accretion, the reduction of the area under fallow, the draining of the fens, the use of grass to restore the fertility of tired ploughland—incidentally, the evidence on p. 89 suggests that grass seed was used as early as the sixteenth century—the cropping changes which Mrs. Thirsk tabulates from local records, all these reflect the steadily increasing pressure on the land which was the prime mover in the rural economy from Tudor to Hanoverian times; even as the "drift from the land" and the rise of the flower and bulb industry in later Victorian times reflect the coming of the foreign competition which so drastically destroyed the immemorial assumptions of British agriculture.

The outline of the story is familiar. The mass of detailed new material which Mrs. Thirsk's researches bring to it is not; and some interesting generalizations emerge. One is the early commercialization of farming and the surprising rapidity with which men remote from markets and preoccupied with routine chores adapted their policies to changing needs. Another is the "chain reaction" stimulus caused by the improvements of the enclosure period as new opportunities called forth new energies. A third is the importance of the "farming ladder" in the fenlands and the tough versatility of the smallholders whom it served—a striking instance of the effect of environment, physical and economic, on character.

This book, however, has one fundamental weakness. It pays little attention to that major theme of agricultural history, technical development. We are told of the importance of field-drainage, but we are not told when cheap and effective methods of deep-drainage first became available. We are told little about buildings or breeds of stock, little about implements and the men who made them. Neither are we given an account of the Holland potato-growing industry which was one of the first and most successful of all the counter-attacks by the arable farmer on the forces which were turning ploughland to pasture—there is not even a mention of Thompson or Dennis or of those plantbreeders' creations, Magnum Bonum and Up-to-Date, on which the new enterprise depended.

This lack of technical appreciation is dangerous, for it affects judgment. In her preface, for instance, Mrs. Thirsk remarks that the First World War "finally killed all interest in the economic advantages of peasant proprietorship . . . by underlining the weaknesses of peasant agriculture". But this is a superficial analysis. War time necessities certainly drove the issue from practical politics. But it was mechanization, not war, which altered the balance of economic advantages by creating new (not underlining old) weaknesses and so prevented its later revival. In short, war only stunned it; technology killed it.

Within its limitations, this is a first-class historical study and a welcome addition to the expanding library of agricultural scholarship. But its limitations are considerable, and greatly reduce its value.

N.H.

Proceedings of the 6th Technical Meeting of the International Union for the Conservation of Nature. 25*s*.

This is inevitably rather a patchwork document. It is an effort to report those parts which have not been published elsewhere of a meeting which considered the principles of nature conservation, as distinct from preservation. Some of the papers are, therefore, merely given in title; the rest are variously in French, English or both.

A leading part in the conference was taken by the Nature Conservancy, and a note of high endeavour was struck by the address of the Director-General, Mr. E. M. Nicholson, entitled "Nature Conservation and the Management of Natural Areas". His theme of the need for management and research to go hand in hand is summed up in his own words: "No management is worth serious attention which does not embody some element of research and experiment, and no research need be considered which does not represent a prototype or test able to contribute to management".

If Great Britain contributed mainly ideas to the discussion, the United States weighed in with a wealth of experience. Dr. Ira N. Gabrielson, President of the Wildlife Management Institute, gave an important paper on the "Management of Nature Reserves on the Basis of Modern Scientific Knowledge". North America has vast areas which need only a little guidance to remain fairly representative of primeval conditions; Europe must reconcile a greater economic need. Nevertheless, the pragmatical considerations of Dr. Gabrielson can, perhaps, be applied with even more force to the smaller reserves and parks which Europe can afford. The mass of smaller papers which follow these two main expositions are varied in quality; some are notably lacking in imagination but, however narrow the viewpoint, they all trend in the direction of minimizing the capital expenditure of the earth's resources.

It may seem paradoxical that, with the world's population still increasing, and with many nations still recklessly flinging away the precious asset of their soil, the conference has been striving to establish principles for safeguarding areas in a primeval state. But the movement is the first sign of a serious and widespread desire to redress the rapidity of the earth's rape. The approach is sensible: first, as a primary and limited measure, to keep some areas on the earth's surface under their natural climaxes; secondly, to explore ways of managing the rest which reconcile economic needs as far as possible with the conservation of resources.

Order forms may be obtained from the Nature Conservancy, 19 Belgrave Square, London, S.W.1.

H.N.S.

Cereal Diseases in Ireland. ROBERT MCKAY. The Sign of the Three Candles (Dublin). 21*s*.

Cereals are subject to many diseases, and those which are of consequence in Ireland are dealt with in this latest book of Professor McKay's series on crop pathology. The facts are marshalled in such a way that the reader is given a clear picture of field symptoms, microscopic detail of infected plants, progress and importance of the disease, and control measures. Not only are fungal parasites considered, but there is also a short chapter on eelworms, and one describing physiological disorders and spray damage.

The author states in the preface that the book is intended as a guide for the identification of cereal diseases in the field, and this function it will certainly fulfil. The numerous black and white plates are of excellent quality and illustrate well the diagnostic features of the most important diseases; the colour illustrations are also helpful in this respect. While aiding the specialist, the book will be equally useful to the reader with only slight technical knowledge, since Professor McKay has written with rare clarity and precision. A glossary defines most of the technical terms which it has been necessary to use. Relatively few references are given, and the author states that he has deliberately reduced them to a minimum. This is in some cases a pity, because the few which have been selected for inclusion are not always those which give the latest information available.

It is unfortunate that there is no reference supporting the statement that the ripe ascospores of *Ophiobolus graminis*, causing take-all, "get washed down into the soil, where they germinate and cause infection in the roots of suitable hosts with which the hyphae come in contact", in view of the unsuccessful attempts by

Garrett to induce infection in this way. The book is, however, a valuable one which will be of help to all concerned with cereal health and disease, not only in Ireland and Great Britain, but wherever wheat, barley, oats and rye are grown.

R.L.L.

Field and Farm. RICHARD JEFFERIES (Edited by SAMUEL J. LOOKER). Phoenix Press. 15*s*.

Once again we are indebted to the devotion of Samuel J. Looker for more evidence of the equally devoted industry of Richard Jefferies in recording the blessings and vicissitudes of the Wiltshire downs and Gloucestershire villages he loved so well. Few men in so short a time—Jefferies was only 38 when he died in 1887—have made so varied and sincere a contribution to the annals of the countryside.

In *Field and Farm* Mr. Looker has chosen some forty essays, some from manuscripts never before accorded the light of day, but most republished for the first time since their appearance, unsigned, in various periodicals to which Jefferies contributed as "uncrowned special correspondent" on rural matters of every kind, and to which, as this collection testifies, he lent not only a sensitive but a singularly well-informed and speculative mind. Could he otherwise be read as widely as he is today?—especially with his feet set on the ground; for some still find Jefferies with head in the air rather strong meat.

Field and Farm is a companion to *Chronicles of the Hedges* and *Hodge and his Masters*. But whereas *Hedges* presents mainly nature studies and *Hodge* the personalities and institutions of the countryside—the squire and parson, bank and Petty Sessions—this third volume treats rather of their livelihood, the issues at stake, so akin to those facing farmers today; and I wish they might be resolved with Jefferies's fair play and far-sightedness, so shrewdly tinctured with native common sense.

A few facsimile pages and sketches from Jefferies's notebooks are offered as illustrations and, for students of his style and books, there are some useful appendices. Included also is the tribute paid by Mr. Looker at the centenary of Jefferies's birth, which is so eloquently that of a man for his close friend that one finds it hard to realize that Jefferies's death must almost have coincided with his disciple's birth.

E.A.R.E.

The Agricultural History Review (Vol. V, Part II, 1957). Edited by H. P. R. FINBERG. British Agricultural History Society. 12*s*. 6*d*.

It may seem odd, in a review of a Review, to single out for special comment the book review section. But the editor himself would probably not think so, otherwise he would not devote almost half his available space to reviews, or enlist the services as reviewers of such leading figures as Professor Edgar Thomas, Dr. Edith Whetham, M. W. Beresford and G. E. Fussell. These sixteen close-printed pages of reviews provide an invaluable synopsis and critique of current literature in the field of agriculture. The new Review will acquire for itself an enviable reputation in this branch of literary criticism if such a high standard is maintained.

By contrast, the articles themselves, scholarly though they are, make rather tedious reading. Either they require too specialized a knowledge to be readily intelligible to the uninitiated, as is the case with the article on "Slash-and-Burning" techniques in neolithic agriculture, or they are overloaded with references which might well have appeared as footnotes. Whilst appreciating the motive behind the meticulous quoting of evidence, itself a vital ingredient in historical method, it is surely true that agricultural history is an essentially human, down-to-earth study which demands more an instinctive "feel" for the subject than a sophisticated and esoteric approach.

All four articles in this issue are devoted to origins. The first, already mentioned, discusses the origins of agriculture itself; two deal with the origins of those traditional symbols of the two-fold division of agriculture since the time of Cain and Abel, the plough ("The British Plough: Some Stages in its Development" by F. G. Payne) and the shepherd's crook ("Some Notes on Shepherd's Staves" by L. F. Salzman); and the fourth is about the origins of the rabbit in England—quite logically, but a little unnaturally,

the author resists the temptation even to mention the word "myxomatosis"!

Finally, this issue contains another of those useful (and revealing) summaries of "Work in Progress" in the sphere of agricultural history. The compiler is Dr. Joan Thirsk.

Single copies of the Review may be obtained from the Secretary, The Oxford University Department of Agriculture, Parks Road, Oxford.

B.E.C.

Changing Patterns in Israel Agriculture. HAIM HALPERIN. Routledge and Kegan Paul. 28*s*.

For many years Dr. Halperin held a prominent position in the Jewish Agricultural Workers' Organization, was the first Director-General of the Israeli Ministry of Agriculture, and is currently the Director-General of the Israeli Bank of Agriculture. In these important posts he has had a unique opportunity of following the fortunes of the new state, and in this book he discusses the impact of political independence upon the agricultural economy of the country, sets out the progress of industry and assesses the possibilities and direction of future expansion.

The Jewish return to a recognized nationhood, after an unremitting struggle for independence over seventy-five generations, has always been conceived as a return to the land. The successful adjustment of the immigrants—most of them unaccustomed to manual labour—to a new and arduous life, and the welding together of the numerous and varied tribes of Israel into a single nation, compel the admiration of all who can appreciate the magnitude of the obstacles.

The first task of the early days was to house the new immigrants and improvize methods of agricultural settlement which could cope with this mass influx. How successful this improvization has been can be judged from the fact that fewer than 10 per cent of the settlers decided to leave the new life, strange and arduous though it must have been. Now, with the initial pressure relieved, the main lines of a forward policy must include the establishment of machinery through which financial credits can be made available; the lack of such facilities in the past has been a brake on the wheel. There must, too, be direction as to what crops to grow, both for food and for industrial processing, perhaps by means of contracts with the producer. It is interesting that our own Agriculture Act 1947 is held to be the pattern on which the Jewish policy in these matters might most wisely be based.

To those who have visited Israel, or know and have followed the prodigious efforts exerted in the first two decades of this new-born state, this book will bring great interest and satisfaction, and put into proper perspective some of the problems which from time to time have troubled our own industries.

J.H.A.

The Life of the Shrew. PETER CROWCROFT. Reinhardt. 15*s*.

There is no doubt that this is the most authoritative work on British shrews that has yet been published. Dr. Crowcroft not only assesses the findings of earlier workers in this field but, by his own researches, throws much new light on the subject. Incidentally, in the process he explodes some hardy and popular fallacies.

What, I think, must strike the amateur naturalist most forcibly is the author's skill in keeping shrews in captivity. As he says, the study of such small and unobtrusive mammals in the wild state is one of very considerable difficulty, and probably he himself would agree that much of the new information he offers has been made possible by his success in keeping his subjects alive and well and with no important deviation in behaviour.

Perhaps the most interesting chapters in the book are those dealing with the reproduction of shrews and the growth and development of the young. How many naturalists know that the gestation period of the common shrew is no more than twenty-one days, that at eighteen days, young common shrews are still blind, and that their weight at birth increases tenfold in as many days?

Often I have wondered how such inoffensive and, indeed, useful creatures could have acquired the evil reputation they once had. According to our forbears, shrews gave to man almost everything from chilblains to bubonic plague, and to his livestock almost every ill to which they were prone. Shrews were most vilely

mistreated; many an unfortunate one was walled up alive in a hole bored in an ash tree, so that some pinchbeck wizard could use a branch of the "shrew-ash" with which to work one of his "cures".

As Dr. Crowcroft says, there is still much to learn about shrews, but it is very useful to the student to have, in one volume, practically all that *is* known about them so far. The book is well and plainly written; free from the jargon which some scientific writers deem it necessary to inflict on the inquiring reader.

F.H.L.

The Pig Farmer's Veterinary Book (Second Edition). N. BARRON. Dairy Farmer Books. 16*s*.

Veterinarians will agree that losses in pigs, and especially in little pigs, are very high, and doubtless many deaths could be avoided by improved methods. In the second edition of *The Pig Farmer's Veterinary Book* the first four chapters outline the basic principles of pig management with special reference to the prevention of losses. The author stresses the intolerance of pigs to cold and wet housing.

Other chapters deal with disorders following farrowing, and those caused by parasites, viruses and bacteria, poisoning, etc. The four notifiable diseases of pigs are competently discussed, and an appendix contains practical suggestions for the pig-keeper's medicine chest. A folded chart gives, perhaps too concisely, the cardinal signs and symptoms of no less than twenty-eight diseases which are said to be common in pigs.

Dr. Barron recommends a number of anti-anaemia measures and gives pride of place to dosing three times with a liquid mixture of iron and molasses. This is certainly not the easiest method; other things being equal, it is simpler to give a single iron injection. Time is money in the pig-sty too! Frequent mention is made of pig oil, but not everyone knows what this is. A misprint occurs on page 49, where the sugar content of sow's milk is given as 5·9 per cent, whereas it is about half this value.

Altogether, this revised edition which includes much new information is a very useful book for pig farmers.

W.L.S.

Wild Flower Guide. R. S. R. FITTER. Collins. 3*s*. 6*d*.

This book contains general but reasonably accurate descriptions of over 650 wild flowers, together with drawings of representative kinds, and eight plates in black and white devoted to some of our best known wild orchids, a few parasitic plants, and some much appreciated rarities like Star of Bethlehem, Cheddar pink and spring gentian. It is designed to help the less botanically-minded lovers of wild flowers to name the more familiar kinds they may come across in a country walk; the flowers are classified as yellow, red, blue, white or green, and each group is illustrated by line-drawings showing the form and flower detail of the kinds selected as representative.

A stranger to English wild flowers finding ragged robin and red campion on the same day in the same locality should have no difficulty in placing them in their colour group and separating them by their flower shapes and petals, points clearly shown in Pamela Freeman's drawings. In the yellow-flowered group he might find it a little more difficult to sort out cow wheat from yellow rattle, and the round-leaved fluellen could well puzzle him and leave him wondering what a "narrower pointed halberd-shaped" leaf really looked like.

One of the best pages of drawings in the book (page 203) is by Evangeline Dickson, and had the time and place both been right, could well have sent me out to search for adder's tongue and moonwort!

H.W.M.

Catalogue of Lewis's Medical, Scientific and Technical Lending Library, 1957. 42*s*.

Lewis's catalogue is more than a library adjunct; it is an up-to-date survey of current publications in a specialized field. The latest edition covers the library's stock up to the end of 1956, replacing the edition of 1949 and the separate supplement of 1952.

The main part of the work comprises 830 pages of entries arranged alphabetically by author and title, with details of publication date (and place, if outside the U.K.), price and size. Complementary to this is an alphabetical subject index, where

lists of authors alphabetically arranged appear under the subject headings. There are 10 pages on agriculture, subdivided into such topics as animal husbandry, chemistry and bacteriology, crops and pastures, etc., as well as many other related subject headings in pure and applied science.

F.C.H.

Agricultural Research Institute of Northern Ireland Thirtieth Annual Report, 1956-1957.

The Agricultural Research Institute of Northern Ireland is best known for work in connection with pigs and poultry. During 1956–57 its facilities were expanded, and the report includes information on the new work now being undertaken.

A new, individual-pen pig-house is in use for progeny testing and the breeding herd has been increased by rearing 25 per cent more litters. Weaning at fourteen days and rearing on sow milk substitute has further increased throughput in existing buildings, two or more litters being housed in each pen. So far, no boars have been found giving progeny with outstanding carcass quality.

Stilboestrol introduced into pigfeed at the 100 lb liveweight stage improved grading by reducing backfat thickness. Improved liveweight gains were obtained with weanling pigs self-feeding *ad lib.* on meal supplemented with ¼, 1 or 2 lb copper sulphate per ton of meal, and also with weanlings on low-energy, high-fibre diets supplemented with 5–7½ per cent fat. The addition of fat to high-energy cereal diets produced no additional gains.

A new breeding scheme for production of hybrid laying hens by selection based on progeny tests of cross-breds in battery cages has been adopted. Light Sussex and Brown Leghorns are being used. As this method avoids expensive preliminary inbreeding, the results will be equally interesting to scientists and practical breeders.

Grassland experiments confirmed that 3 cwt per acre of potash greatly increased clover in a no-nitrogen sward, yields of dry matter being little lower than from swards receiving 1 cwt per acre of potash plus 3 cwt of "Nitro-Chalk". All plots received 2 cwt per acre of superphosphate.

Veterinary research included investigations of build-up of *Nematodirus* infection during intensive sheep grazing, and vaccination for staphylococcal mastitis.

Copies of this report are obtainable free from the Agricultural Research Institute of Northern Ireland, Hillsborough, Co. Down.

S.L.

Long Ashton Research Station Annual Report for 1956. 15*s.*

The progress of investigations, which include those on fruit production, fruit diseases and pests and fruit preservation, is discussed in a general summary and described more fully in a series of separate reports, which contain many points of interest to the grower.

In trials of cropping systems for Cox's Orange apples, dwarf pyramids gave the highest yield—550 bushels an acre—of the four systems tested.

In the wet summer of 1956 crop losses of gages due to split fruit were severe. Splitting was, however, much less severe in culinary plum varieties and Marjorie's Seedling was again outstanding in its comparative freedom from split fruits.

Black currants seem highly tolerant of 2:4:5-trichlorophenoxybutyric acid, which suggests that it may prove useful in controlling perennial weeds, particularly bindweed, in black currant plantations.

There is an interesting account of the role of natural leaf waxes in protecting leaves from infection by fungi. Other papers deal with the characters of perry pears, the propagation of gooseberries, the manuring of Royal Sovereign strawberries, fruit drop in black currants and growth substances as thinning agents for apples.

Increase in the yield of Cox's Orange apples, following the substitution of captan for lime sulphur spray treatment, has been shown to be related to differences in fruit set and fruit drop.

Spray application problems are the subject of a number of investigations, mainly directed towards improving spraying technique, for example, methods of determining the efficiency of sprays and improvements in spraying machines.

Copies of the report can be obtained from the Secretary, Long Ashton Research Station, Bristol.

A.J.L.L.

Business Aspects of Horticultural Production under Glass. R. R. W. FOLLEY. Department of Agricultural Economics, Wye College. 5*s*.

This is the first of a series of reports to make an economic assessment on a worthwhile scale of British intensive horticultural production.

The study covered a wide area, and a large number of nurseries. It was detailed in character and naturally took time. Although it uses the most up-to-date information available, the report deals with circumstances which prevailed three years ago, some of which have changed considerably.

In addition to the costs included in the various tables, other items of importance, such as the interest on borrowed capital, mortgages, and overdrafts, often figure in the accounts of a holding. Overdrafts probably affect many of the smaller nurserymen with whom this report is concerned.

There are factors which influence the financial results of a horticultural undertaking but cannot be considered in a study of this kind. For example, business acumen may well be a more important factor than skill and efficiency as a grower. This cannot be measured in terms of figures, but is nevertheless of great importance.

All this is not to criticize the report, but to draw attention to some of the difficulties involved in an investigation of this kind. The fact that these difficulties occur, or that criticisms may justifiably be levelled at some of the figures given or statements made certainly should not deter growers from reading the report or from thinking very seriously about matters which are of vital importance to them.

Mr. Folley is to be congratulated on the clear and concise treatment of an extremely difficult subject.

H.F.

Rural Industries Loan Fund Report for 1956–57. 2*s*.

The aim of the Rural Industries Loan Fund is to encourage the sound economic development of small rural industries (excluding agriculture) by making loans towards the provision of efficient machinery and workshops.

There are two schemes, both financed by H.M. Treasury through the Development Fund. One facilitates the acquisition of modern workshop equipment such as arc-welding plant and powered tools, the other is designed to assist in the erection, adaptation, extension or purchase of workshop premises.

Details of these schemes and information about the technical and advisory services available to craftsmen from the Rural Industries Bureau, are given in the report, which can be obtained from 26 Bedford Square, London, W.C.1.

Books Received

Origins of Ownership. D. R. Denman. Allen and Unwin. 22*s*. 6*d*.

Breeding Better Cows. Craig Wheaton-Smith. Dairy Farmer Books. 16*s*.

Managing Southern Soils. (Southern Farm Series.) H. B. Vanderford. Chapman and Hall (London), Wiley (New York). 38*s*.

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